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OF THE

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PAPERS

AND

DISCUSSIONS.

REPORT OF COMMITTEE ON STREET PAVING.

Chairman, Allen W. Dow, Consulting Engineer on Street Paving.

While no distinctively new type of pavement has been developed during the past year, there have been a number of changes in the present types, some for the better and others of very doubtful value.

These changes have not alone been confined to the technology of the industry, and in fact the most important have been rather of an economic nature. This is principally true of the asphalt paving industry, which has been undergoing most remarkable development, brought about by an unusual economic condition. These developments have had and are still having so direct and important a bearing on the quality and character of the paving work as to demand serious study and consideration. In this age of combinations, when most industries have been combining to economize in the production and raise prices by stifling competition, the asphalt industry has been divided into several factions, each fighting the other with a competition that in many cases has carried the price for work below the cost of proper construction. As there are but few philanthropists in the paving business, these conditions have naturally brought about a skimping of the work, principally in the adulteration by or substitution of materials cheaper than those called for in the specifications. As these substitutes and adulterates are inferior in quality to those formerly used, we can expect an era of bad pavements, and in fact it is evident to

any observing engineer that there has been more inferior work done in the past few years than ever before in the history of the industry.

These undesirable conditions reached their climax during the past year, and it is gratifying to note that prices have materially advanced during the season. It is to be hoped that city officials in the future will give more attention to the economics of the industry and reject bids that are too low to insure a reasonable profit to the contractors.

The branch of the paving industry that might be said to have advanced and extended more during the year, is that of the treating of cheaper classes of paving, such as dirt, macadam, and gravel roads, so as to the better withstand the traffic conditions incident to the extensive use of automobiles with rubber tires, which, while they pull the road to pieces, do practically no grinding and compressing such as results from horse traffic with steel tired vehicles. This treating of road surfaces is divided into two distinct classes. The first, sprinkling of roads with oil or other materials for the purpose of laying dust. The second, where a material is sprinkled on the road for the purpose of making a wearing surface. These two classes are too often confounded with each other, resulting from a miscomprehension of conditions both of the quality of the materials and local requirements. This invariably results in the waste of money and time in needless experimenting.

The quantity of asphalt paving done in the past year is slightly less than that of the previous year. It is to be hoped that the great amount of poor work which will naturally result from the use of inferior materials and cheap workmanship will not injure the reputation of this class of paving.

There has been a slight increase this year in the yardage of bitulithic paving laid over that of last year. This pavement is being laid with increased care, resulting from the experience that has been gained in the past. One noticeable change is that these pavements are being laid richer in bitumen than formerly.

The quantity of treated wood block pavements is increasing materially each year as municipalities gain faith in this new treatment of wood for this purpose. Improvements are being made in the manufacture of wood block as experience dictates. It is now well established that the heavier the creosote oil the more durable the timber, not alone for paving blocks but for all purposes. This subject is discussed more fully and comprehensively by the United States Department of Agriculture in their Forest Service Circular 98, "Quantity and Character of Creosote in Well-Preserved Timbers," by Gillert Alleman.

There has been considerable brick paving done during the past year and the brick manufacturers are beginning to more fully realize that a most important factor, even as important as the quality of the brick, is the proper laying of the pavement, and especially the quality and application of the grouting.

DENSITY OF A PAVEMENT AN IMPORTANT ELEMENT OF ITS DURABILITY.

By J. W. Howard, Consulting Engineer on Pavements.

It is an axiom in many branches of engineering that density increases the stability and durability of structures. This applies to pavements which must resist pressure and attrition of that which comes in contact with them. The density resists the effects of traffic and weather in proportion to the degree of density a pavement possesses. The pressure and shock of wheels of vehicles and hoofs of horses are best resisted by a concentrated dense mass. This applies to each kind of pavement and helps not only to determine what kind of pavement will best resist a known or estimated quantity and weight of traffic, but also helps determine which one of the various grades or densities of each kind to specify and accept. It helps us select the best blocks among any of the following groups: granite, basalt, trap, wood, brick or asphalt blocks.

Density is a very important quality in all composition pavements laid in monolithic or sheet form, such as asphalt, bitulithic, etc. That which is densest (other elements, as proper materials, mixtures, etc., being equal) is to be preferred. This is illustrated by the fact that the natural bituminous limestone or rock asphalt pavement of Europe is denser, closer grained and more durable than many but not all of the artificial asphaltic sandstones which are the principal asphalt pavements laid in American cities.

I am speaking from a scientific standpoint, which affects first cost and especially the cost of maintenance of pavements. Density and consequent longer durability reduce the cost of maintenance which in the end is the greatest cost because maintenance goes on forever. Asphalt mixture pavements, composed of sand, limestone dust, and asphalt-cement, too often lack density and are porous. In such cases they do not

resist traffic and weather as well as if they were of the maximum density possible with proper mixture and by proper compression. The bitulithic pavement is an example of concentration of as much mass as possible in a given space. It aims to assemble crushed stone so that there is a minimum of voids and approximate the original solid stone from which the crushed stone is obtained. The density of the composition of bitulithic pavements, combined with the density of hard stone used, is probably the principal reason for the degree of success which that special pavement has attained.

The same reasoning applies to all other kinds of pavements; different bricks, different woods, etc., proposed for paving different streets. Each kind of pavement, granite block, bitulithic, asphalt, etc., is suited to certain kinds, locations and characters of streets. The knowledge of the comparative densities of these different materials reduced by tests to definite figures, helps determine what kind of pavement to use for different streets and further helps determine which one of many granites, bricks, composition pavements, etc., offered, is best to accept and use in each case. Requirements of minimum density for each kind of pavement should be inserted in all specifications in order to help secure, in conjunction with other and usual requirements, the best possible pavements.

Pavements involve two kinds of density. First: We must record the density of the pavement including its voids. This is the most important because it is of the actual pavement laid. It is the weight per unit (cubic inch or cubic foot) of the given material, granite, brick, asphalt, pavement, etc. It can be expressed in pounds or as specific gravity of the pavement, dried before testing and with air but no moisture in the voids of the piece of pavement tested. This density may be called *volume-weight* (raum-gewicht) and is determined by the methods described in any good physics or natural philosophy. Second: We must record the density or specific gravity of the materials or mineral matter of which the pavement is composed, exclusive of any voids present in the pavement. This

is the true specific gravity of the material or materials in the pavement and is determined by methods described in any good book on physics.

To illustrate the two densities, one of the finished pavement and the other of the material entering into the pavement, let us consider a certain Baltimore bitulithic pavement made of crushed stone so graded in sizes and assembled by mixing that a very small per cent of the volume is unfilled voids. I found a specific gravity of a large piece cut from the pavement to be 2.69, whereas the solid stone of the same kind as the crushed stone in that pavement had a specific gravity of 2.96. The pavement is a small fraction (9%) less density than the stone which is its principal element. The first is the specific gravity or density of the pavement as laid. The second is the specific gravity of the mineral (stone) used in that pavement. The asphalt pavements of the United States, as laid, vary in density or specific gravity between about 1.90 to 2.24, whereas the density of their largest elements, sand and limestone dust (exclusive of voids), is between about 2.60 and 2.70. These pavements are therefore 16 to 23 per cent, or average of about 20 per cent less than the density of their principal mineral elements. The requirement in specifications for some wood pavements that the blocks when dry must at once sink in water, is a crude way of requiring that the wood must have a certain degree of density. It is better to express this by definite figures.

Valuable deductions at once follow from knowing the density or volume-weight of the pavement, including voids and the density of its materials excluding voids. Thus we would have numerical means of comparing qualities. The *density-grade* (or per cent of density) and the *void-grade* (or per cent of voids) of a pavement can be found. The density-grade (d) is obtained by dividing the volume-weight (w) of a pavement by the density or specific-gravity (s) of the materials of a pavement, $d = \frac{w}{s}$. This is the per cent of the pavement which is

solid mineral matter, which should be as large as possible. The void-grade (v) is obtained by subtracting the density grade from unity, $v = 1 - d$, which is the per cent of voids in the pavement, which should be as small as possible. For example, in the Baltimore bitulithic pavement referred to, $w = 2.69$, $s = 2.96$, $\frac{w}{s} = d = 91\%$, which density grade means that 91 per cent of the pavement is solid stone. Then $1 - d = v$, $1 - 91\% = 9\%$, which void-grade means that 9 per cent of voids exist between the broken stone which volume or space is filled with fine dust and bituminous cement. Asphalt, brick, wood and other pavements can have their density-grades and void-grades determined in the same manner.

Laboratory tests and data obtained thus show practical and valuable facts. Each pavement should have the highest possible density-grade and the lowest possible void-grade of the general kind of pavement to which it belongs.

At a future time I may venture to present certain results of tests of densities of various successful and unsuccessful pavements in use, which I have been making in my pavement testing laboratory at intervals for several years. These may indicate what minimum densities should be required of certain paving materials and pavements.

Without going into further details, I think this brief paper is sufficient to show the importance of study and records of the densities of the various general kinds of pavements and of each specific one of each kind. Laboratory tests, combined with observation of the results in actual pavements in use, soon produce definite numerical requirements of density which can be inserted in pavement specifications. This will be another step toward solving the paving problem.

REQUIREMENTS AND TESTS FOR BEST QUALITIES OF PAVING BRICKS.

By J. W. Howard, Consulting Engineer on Roads, Streets and Pavements.

Because many cities have difficulty in obtaining durable paving bricks, city engineers and others have often asked me to state from the experience of my pavement testing laboratory (in which all kinds of paving materials, asphalt, wood, bricks, etc., have been tested for many years), and from inspection of brick pavements in use, what requirements and tests, if inserted in specifications, will insure a city obtaining the most durable grades of paving bricks; provided, of course, the samples submitted for use and the subsequent deliveries of bricks are regularly tested by standard, uniform methods and by an experienced, unprejudiced engineer in a properly equipped laboratory.

The worst enemies of brick pavements are bad paving bricks. There are many cities suffering from having used paving bricks which soon became chipped, broken and uneven from the effects of weather and traffic, simply because those cities did not insert in their specifications proper requirements and tests for the bricks to meet before use. We all know that the location of some cities near poor paving brick works, cheap bricks, failure to test bricks, as well as influences outside of the control of engineers, cause many cities to use bricks which are deficient in durability. Moreover, careless and improper culling or selection of good bricks from each kiln, even at works which have shales suited for making the best grades of paving bricks, too often permits bad bricks to be mixed with good ones.

Many brick plants have not the right kind of clay or other materials to make the most durable paving bricks. Very few fire clays are suited for making paving bricks. Only those

impure fire clays which contain a large amount of fluxing or annealing minerals, make paving bricks worthy of consideration. Even then it is seldom, if ever, that fire clay paving bricks are as durable as the best grades of paving bricks made from suitable shales. In making this comparison I assume that the mechanical operations of manufacturing both classes of bricks are equally well done.

A complete chemical analysis of the fire clay, shale or other material in the dried, unburned brick or of a finished brick, will clearly show whether or not the material can be made into a high grade paving brick. It reveals what fluxing or annealing minerals are present and if in proper proportions.

There are certain definite physical requirements and laboratory tests, which, if they are all applied to samples submitted for use and to the various shipments of bricks before use, will protect a city against bad bricks and insure the use of good bricks. I omit reference to the proper foundation, laying pavement, etc., as not germain to the selection and testing of bricks.

An experience of many years testing thousands of samples of about 165 makes or brands from different parts of the United States, and observing their successes or failures on streets of cities, makes me conclude that the requirements and tests of quality given below will practically eliminate the use of bad and help obtain good bricks.

The small brick size is seldom used. The larger, or block size, is best for several reasons, especially because there are less joints to wear.

The following is not intended for a complete brick pavement specification, but is a portion which can be inserted in such specification:

THE REQUIREMENTS AND TESTS FOR PAVING BRICKS for use under the specifications of which these requirements and tests form a part, and which the bricks must conform to, are as follows:

a. SAMPLES. Paving bricks of block sizes must be submitted by the bidder and must be twelve (12) in number, properly boxed for sending by express to a testing laboratory or elsewhere. The box must be marked with the name of the bidder and date of bidding. Subsequent samples

must be furnished by the bidder and be permitted to be taken by the proper representative of the city from subsequent shipments of blocks, before the use of each shipment for paving on the streets under contracts of which these specifications form a part. The proper representative of the city in case of doubt may also select a reasonable number of sets of samples of twelve (12) blocks each, from pavements constructed under these specifications.

b. REQUIREMENTS AND TESTS may be made of each kind or brand submitted by the bidders before awarding contracts, and are to be made at suitable intervals on samples taken from shipments of bricks before their use in the pavement. The samples can be taken from the cars or boats on arrival, or from piles adjacent to the location of the work or from the pavement. The tests shall be made by standard machines and uniform methods and by a competent and experienced man, and if possible in a regularly equipped laboratory.

c. THE SIZE of bricks shall be what is known as block size and shall not vary more than one-quarter inch (¼") in any block. The preferred size shall be 8½x3½x4" exclusive of all lugs or projections; but bricks of other dimensions may be accepted for use provided the depth is four (4) inches.

d. PROJECTIONS or lugs are required and must either be the name of the brick on it or other suitable projections of about one-eighth inch (⅛").

e. THE BRAND OR MARK of the brick, to identify it by name or otherwise shall be on each brick. No blank bricks will be allowed to be used.

f. THE SHAPE of the bricks must be uniform, regular and must not be distorted more than one-quarter inch (¼") from the straight edge laid in any direction on them. Edges must be rounded. Repressed brick only shall be used.

g. THE MATERIAL of the bricks must be homogeneous, uniform, free from laminations, cracks and voids. Only very minute fire checks will be allowed. The material shall be thoroughly annealed, fused and vitrified to toughness without excessive brittleness.

h. THE COLOR of the exterior of the bricks shall be chocolate, light or dark brown or red, or a blending of these, and the interior shall be the same or a blending of the same colors. All bricks in any one pavement must be of the same shade.

i. ABRASION OR RATTLER TEST must be in the standard rattler and by the method of the National Brick Manufacturers' Association and American Society of Municipal Improvements. The ***maximum*** loss of any one brick shall not exceed eighteen per cent (18%) of its original dry weight. The ***average*** loss of all bricks tested at any one time must not exceed

fourteen per cent (14%). The standard abrasion machine or rattler is a cylinder of fourteen staves or sides, one-fourth inch (¼") apart, inside diameter 28 inches, length 20 inches, no interior shaft, revolving at 30 revolutions per minute for one hour, containing a charge of 300 pounds of foundry iron shot of two standard sizes; and the charge of bricks for a test must approximate 1,000 cubic inches, which is about nine (9) bricks of the block size. Record of each brick in each test must be kept.

j. THE MODULUS OF RUPTURE OR CROSS BREAKING of any one brick must not be below 2,500 pounds. The average of all bricks tested must not be below 2,700 pounds by the regular formula : $M = (3WL) \div (2AD)$ in which $L = 6$ inches between supports. $W =$ breaking pressure. $A =$ area of cross section at break. $D =$ thickness of brick. The bricks shall be tested on the side and the pressure applied half way between the supports. At least three bricks must constitute this test.

k. THE ABSORPTION of water, by any one brick, shall not be greater than three per cent (3%). The average absorption of all bricks tested shall not exceed two per cent (2%) of their dry weight. The absorption tests shall be made upon either abraded or on broken bricks by drying them for twelve hours in an oven and then soaking them for twelve hours in water. The increase in weight due to water absorbed, divided by the weight of the dry brick, gives the per cent of the water absorbed. At least three bricks must be used for this test.

l. THE DENSITY or specific gravity must be determined of the material of the brick, exclusive of its porosity, and no brick shall have a density of less than 2.30, and the average density of all bricks tested shall not be less than 2.35.

m. THE HARDNESS is determined by Moh's scales for minerals, in which 100 is the diamond. The hardness of any brick must not be less than 60 and the average hardness of bricks tested must not be less than 65.

n. CRUSHING RESISTANCE must not be less than 7,500 pounds per square inch for any brick, and the average resistance to crushing of all bricks tested must not be less than 8,500 pounds per square inch. The crushing tests must be made on about one-sixth middle sections of bricks with pressure applied in the direction of the whole thickness of the brick, which is the least dimension of the brick. At least three bricks must be used for this test.

o. CHEMICAL TESTS may be made at the option of the city engineer or other authorized city official to determine if there is any water-soluble substance, as free lime, potash, soda, etc., in the bricks, and if present to more than a trace, the entire lot of bricks from which the samples have been taken, shall be rejected.

p. Records of Tests of each individual brick of each test, signed by the person or persons who made them, must be kept on file by the city engineer or other proper official, during the continuance of the contract, and must be open to inspection of all persons financially interested in the contract and to such other persons properly authorized to inspect these records.

q. Brands or Makes of bricks previously used in pavements in this city, may, at the option or permission of the proper official, be used by contractors for new pavements without submitting samples of said brands in connection with their bids; provided the bidders state the name of the brand or make of brick or block he will use, and provided the said brand or make shall have previously met all the requirements and tests above mentioned, said tests having been made by or for the city and records thereof found in the proper files of the city. This provision does not relieve the contractor nor city from having all shipments of bricks or blocks regularly tested before use in pavements, as provided for by these specifications.

It is with pleasure that I present the foregoing requirements and tests for the best grades of paving bricks for use of members of the American Society of Municipal Improvements in the many cities where they live, as well as by such other persons who may desire to use them. The cost of such tests is very small. It is practically a great oconomy, because every dollar paid for efficient tests in advance saves several hundred dollars, sometimes thousands, in early repairs to poor pavements. Samples of brick and other paving materials are easily sent by express to laboratories especially equipped to test them. The results are quickly reported to the city engineer or other official who thus seeks to provide his city with the best possible paving materials whether brick, asphalt, bitulithic, granite, etc., each in its proper place and laid after regular tests and under proper inspection during construction.

DISCUSSION.

MR. JAMES OWEN, of Montclair, N. J.: One question I would like to ask Mr. Howard about this question of density. I think it is a pretty well known fact that a common pavement or a common material will vary in its wearing powers according to the manner in which it is laid. Put a brick pavement on a concrete bed with a very light cushion of sand and compare that with a pavement that is laid on an ample cushion of sand, experience I think has shown that the pavement with the heavy cushion will outwear to a large extent the other pavement, and that brings up to my mind other points in this investigation, and I would suggest it to Mr. Howard and that is a question of resiliency of the material itself. The thought struck me rather forcibly when Mr. Howard said an overburned brick, a vitrified brick would be glass. Now we all know that glass is one of the most elastic substances that exists; in fact it is pretty nearly the apex of elastic material. If we take in the question of resiliency of material, and couple that with the density, I think then an investigation of those two lines would give a complete result; but it seems to me to take a material laid in one shape and compare that with the same material or another material laid in another shape would not give a complete result.

MR. HOWARD: I thought I had a clause in my paper—perhaps I omitted to read it—in which I assumed that all these materials which we are comparing were laid under like conditions. I am glad of the suggestion of Mr. Owen, and I shall watch that much closer than I have in the past.

MR. GEORGE W. TILLSON, of Brooklyn, N. Y.: I should like to say that I think this question of density for such pavements of such materials as asphalt and bitulithic and brick is very important. Of course the whole theory of those artificial mixtures is to get as compact and dense a pavement as possible, and while that has been recognized by engineers for a good while, there have been, as far as I know, no specifications that have attempted to say just what that should be, and perhaps with our present knowledge it is better not to put in a definite figure for specific gravity for these different pavements until we know just how it should be and how and when it should be measured. As, for instance, in the case of an asphalt pavement, after it has had a certain amount of traffic it will be much more dense and have a greater specific gravity than when first laid, and it is a question whether the specific gravity should be taken when first laid or after it has been down a certain length of time. The natural and probably the better way would be to require a certain specific gravity for the pavement when laid. This, of course, would vary, too, with the sand that you used in the paving, as sand from different localities,

although being suitable from a mechanical standpoint for the asphalt mixture, would vary considerable in weight, and so would have a great bearing and effect upon the specific gravity of the mixture itself. But I think the suggestions of Mr. Howard and the lines of work that he suggests are of great value and they are in the line of working out these artificial pavements in a scientific way and a way that will be of great value in making satisfactory pavements of these artificial mixtures.

MR. HOWARD: I want to say as a compliment to Mr. Tillson that I have noted in the specifications for wood paving in Manhattan, he has inserted certain weight of wood that should be used in wood paving, anticipating anything I might say by practical example.

SPECIFICATIONS FOR TREATING WOOD PAVING BLOCKS.

By George W. Tillson, Chief Engineer, Bureau of Highways, Borough of Manhattan, New York City.

During the last few years wood pavements have attained considerable popularity in this country. Whether they increase or even maintain this popularity depends upon the ability of the blocks to withstand not only the action of street traffic, but also that of time and the elements.

Wood has been used at intervals in street pavements for about seventy years, but never with any permanent success if we except the present movement. This being so, it can be pertinently asked why should any better result be expected now? The answer is that there is one vital difference between the old and the present blocks, as the former were laid in a natural state while the latter are treated chemically.

Pavements wear out or rot out. If their material will not decay, the life varies according to the traffic imposed upon them. But wood in its natural condition is subject to decay and with no traffic at all will last only for a limited time. The object of the treatment then is primarily to prevent this decay. Also all wood swells when exposed to moisture and contracts when subjected to heat. But if the pores of the wood can be filled with a substance that will prevent the absorption of water, it can be kept stable in size, neither shrinking nor expanding during the varying changes in the weather. The object then of the introduction of chemicals is to prevent natural decay and maintain stability in size, so that a pavement will not bulge when wet nor be full of loose joints when dry.

The question, therefore, is, how can these objects be attained? It is generally admitted that the best agent for treating blocks is creosote oil. When the City of Indianapolis, some

eight or nine years ago, began to lay treated wood pavements, it required the blocks to be first thoroughly dried and then impregnated with creosote oil weighing 8.8 pounds per gallon and to an amount equal to ten pounds per cubic foot. But it is probable at that stage of the business not enough attention was given to the character of the oil or the actual quantity used, so that the first pavements buckled to quite a serious extent. The possibilities of a perfect wooden pavement were appreciated, however, and eventually successful pavements of this character were laid.

Some time later an Eastern firm took up the matter of treating wood blocks and instead of creosote oil alone, used a mixture of fifty per cent oil and fifty per cent rosin, twenty pounds per cubic foot. The first pavement of this character was laid in Boston, on Tremont street, in 1900. I quote herewith from a letter received last month from an engineer in the Boston street department as to its present condition:

> I have just been and looked at the wood paving on Tremont street. About three years ago the upper end, perhaps a hundred feet long, was taken up and relaid with the old blocks, with open joints about the thickness of a lath, and grouted with cement and sand, as I remember it. That portion shows wear, the joints have widened and there is some irregularity of surface. The remainder looks very well. On the part most worn, that is near the middle of the street, there is a somewhat rolling surface.
>
> The pavement was laid in 1900, and it has worn very well indeed, as a whole, and is now in good, usable condition.

This is without doubt the best evidence that can be obtained upon this particular kind of pavement. In 1902 a street was paved with this material in the Borough of Brooklyn, New York. In addition to the above, the specifications required that the blocks, when treated, should sink in water, and after having been subjected to a temperature of 100 degrees Fahrenheit for twenty-four hours, should not absorb more than three per cent of water when immersed for an additional twenty-four hours; the idea being to specify a result rather than a method only. The absorption test was considered the most important, the other being preliminary only and an indi-

cation that the proper amount of the mixture had been used. No trouble was ever experienced with pavements laid by the city under these specifications.

As the use of wood spread over the country, different specifications were adopted according to the views of the different officials. Bearing in mind the objects to be attained by the treatment, the method that will produce that result most economically is the best. With the constantly increasing price of all materials used in the production of treated blocks, it is of great importance that no surplus nor unnecassarily expensive material be used. The Borough of Manhattan, New York, probably has more of this treated pavement than any city of this country, and the salient points of the specifications under which the latter portion of them was laid are here given:

(4) The blocks are to be treated throughout with an antiseptic and waterproof mixture, 75 per cent of which shall be creosote or heavy oil of coal tar conforming to the specifications hereinafter set forth, and 25 per cent of which shall be resin conforming to the specifications hereinafter set forth. All parts of each individual block shall be thoroughly treated, and not less than twenty (20) pounds of the mixture per cubic foot shall be injected.

(5) In preparing the blocks to receive the creosote mixture, they shall be placed in an air tight cylinder, in which dry heat, or heat produced by superheated steam, is maintained and raised to a temperature of 215 degrees Fahrenheit, for one hour, for the purpose of expelling moisture; the heat is then to be increased until it has reached 285 degrees Fahrenheit, this heat being maintained for a period of three hours, or until the block is completely sterilized. Application of heat is then to be stopped and the temperature of the cylinder allowed to fall for one hour, or until the same has been reduced to 250 degrees. A vacuum is then to be applied until about 26 inches is reached, and while under this vacuum the creosote mixture is to be run into the cylinder at a temperature of from 175 to 260 degrees, after which hydraulic pressure of not less than 200 pounds per square inch is to be maintained and raised until the individual blocks are treated throughout.

(6) The creosote oil is to conform to the following specifications when tested, as follows:

(7) The gravity at 68 degrees Fahrenheit shall be not less than 1.12. When distilled in a retort with the thermometer suspended not less than

one inch above the oil, it shall lose not more than thirty-five (35) per cent up to 315 degrees Centigrade, and not more than fifty (50) per cent up to 370 degrees Centigrade. The oil is to be free from adulteration; it must not be mixed with or contain any foreign material.

(8) The resin is to be solid resin obtained from pine. It is to be reduced to a fine dust by grinding and then incorporated with the hot creosote oil in a suitable mixing tank until the proper proportions are secured.

(9) After treatment, the blocks are to show such waterproof qualities that, after being dried in an oven at a temperature of 120 degrees for a period of twenty-four hours, weighed and then immersed in clear water for a period of twenty-four hours and weighed, the gain in weight is not to be greater than three (3) per cent.

(40) Fine turnings from the block shall be placed in a suitable extraction apparatus and the oil completely extracted therefrom with ether or carbon bisulphide. The oil so extracted shall be placed in a suitable still and distilled. The portion up to 120 degrees Centigrade, consisting of the solvent, is to be collected apart. The oil shall then be distilled up to 370 degrees Centigrade. The creosote oil thus obtained must conform in all respects to the requirements of paragraph 39, subdivision 7.

(41) The engineer shall have tests and examinations made at the contractor's works of the materials and blocks proposed to be used, and reject any or all of such materials and blocks as he may consider not to be in compliance with the specifications. The Borough President shall appoint an inspector at the expense of the contractor, who shall inspect the lumber and other materials used in the manufacture of the blocks, and the treatment of the blocks; and he shall reject any of such material and blocks as he may consider not to be in compliance with these specifications.

(42) The blocks will be carefully inspected after they are brought on the line of work, and all blocks which in quality and dimensions do not conform strictly to the requirements will be rejected and must be immediately removed from the line of work.

It will be noticed that the rosin used in only 25 per cent and the specific gravity of the creosote oil is 1.12, which would give a weight of 9.4 pounds per gallon as against 8.8 pounds as in the original Indianapolis requirements.

In revising these specifications the writer modified them by specifying that the mixture used should contain *not more* than seventy-five per cent of oil and *not less* than twenty-five

per cent of resin. That pine blocks should weigh as much as water, black gum blocks fifty-nine pounds per cubic foot, and any other kind of wood at least twenty pounds per cubic foot more than the untreated. Also that the blocks should not absorb more than three and one-half per cent of water after having been dried for twenty-four hours at a temperature of 100 degrees Fahrenheit. He also changed the wording of the clause stating the exact method of treatment by making it general in nature, so that a contractor can use any method he pleases provided that he uses the proper material in proper quantity and produces a specification block.

The words "not more" and "not less" were inserted because the author believes that with a correct proportion of rosin and oil there will be no trouble in making a block that will fill the requirements of the specifications. The weight requirement was made so as to ensure as certainly as possible that at least twenty pounds of the mixture is used. This is probably approximate only, but undoubtedly useful.

The writer was probably the person who first proposed the absorption test, and the preliminary drying was not only intended to drive off some of the contained moisture, but also to test the volatibility of the oil used, and the idea was to subject it to a temperature that would produce a result equal to actual use. It was also believed that an absorption of 3½ per cent was sufficiently severe.

In order to ascertain the present practice the writer has compiled from the specifications of the following cities the salient points regarding treatment and tests:

CITY	Mixture			Kind of wood	Tests	
	Character	Pounds per cu. ft.	Specific gravity of oil		Weight	Absorption
Boston	Creosote oil 75% Resin 25%	20	1.12	Long leaf yellow pine; Southern black gum	....	3%
Borough of Brooklyn	Creosote oil 50% Resin 50%	20	....	Long leaf yellow pine	Greater than water	3%
Indianapolis	Creosote oil	20	1.12	Long leaf yellow pine	....	....
Minneapolis	Creosote oil 50% Resin 50%	16	1.09	Long leaf yellow and Georgia pine; Norway pine; Washington fir; Tamarac	....	....
Borough of Manhattan	Creosote oil 75% Resin 25%	20	1.12	Long leaf yellow pine; Southern black gum Norway pine; Tamarac	....	3%

The above represents the general practical difference of the cities in this country and can be considered as representative requirements.

It will be noticed that all of the specifications require creosote oil, and Indianapolis is the only one that does not require it to be mixed with something else. The Brooklyn specifications vary a little from the others in that they allowed as a substitute for resin "or any other suitable waterproofing material." One contract was laid with material other than resin and up to the present time (although only three years have elapsed) the pavement has been satisfactory.

It should be the object of all engineers to reach the desired results in as economical a way as possible, and if 25 per cent of resin is as good as 50 per cent, or if none at all is necessary, it should be left out, as the addition of the resin makes quite an increase in the cost. It will be noticed also that all of the cities but Minneapolis require 20 pounds of material per cubic foot, while Minneapolis calls for only 16. Of course if 16 pounds are as good as 20, there is no necessity for putting in the extra four pounds.

It will also be noticed that while the specific gravity of the oil called for in Boston, Indianapolis and the Borough of Manhattan is 1.12, no specific gravity is given for Brooklyn, and Minneapolis calls for 1.09. It can be said regarding the Brooklyn specifications that they were made several years ago when the question of the oil was not as well understood as it is at present, and no wood block has been laid in Brooklyn for the past three years.

The question of the kind of wood also makes a difference in the treatment. All of the above specifications allow long leaf yellow pine; three allow Southern black gum; and the Borough of Manhattan and the City of Minneapolis allow, in addition, Norway pine and tamarac, while Minneapolis also permits Washington fir. It can be easily understood that black gum, tamarac or fir, woods which contain no pitch of themselves, should require a different treatment than yellow pine. It will also be noticed that the only tests specified for the blocks after they are treated is that Brooklyn requires the blocks to be heavier than water and Boston, Brooklyn and Manhattan require that they shall not have an absorption of more than three per cent of water after having been dried for twenty-four hours and then immersed in water for an additional twenty-four hours.

The question of the specific gravity of the creosote oil is very important, and in order to learn something about the difference in the volatility of oils of different specific gravity, a

test of evaporation was made by the chemist of the Bureau of Highways, Borough of Manhattan, with the following result:

The experiment was carried out as follows: Approximately 50 grammes of each oil was placed in an open cylindrical vessel having a diameter of 3 and 1¼ inches high. The oil was then subjected to a constant temperature of 120 degrees Fahrenheit for a period of fifty days, the oil being frequently weighed as shown in the table below.

Four samples of oil were selected for these tests, two having a light specific gravity and two being heavy oils. These oils, when subjected to distillation, had the following constitution:

Creosote Oils		Distillate			
No.	Specific Gravity	To 315°C	315°—370°C	Total to 370°C	Residue.
S-997	1.055	82.5%	8.5%	91.0%	9.0%
S-1003	1.180	33.4%	13.4%	46.8%	53.2%
S-1008	1.065	83.1%	8.5%	91.6%	8.4%
8-1017	1.190	35.4%	10.9%	46.3%	53.7%

The amount in weight which these oils lost when maintained at 120 degrees Fahrenheit in the number of days indicated is shown in the following table:

CREOSOTE OILS.

Loss in Weight at 120° F.

No. of Days	S-997 Sp. Grav. 1.055 Total Loss	S-1003 Sp. Grav. 1.180 Total Loss	S-1008 Sp. Grav. 1.065 Total Loss	S-1017 Sp Grav. 1.190 Total Loss
1.	13.3%	6.2%	10.9%	3.8%
2.	20.8%	9.1%	18.2%	5.7%
3.	26.8%	10.7%	24.2%	7.4%
6.	41.1%	13.3%	39.1%	9.9%
10.	53.1%	16.0%	49.7%	12.7%
15.	58.9%	18.1%	54.4%	15.0%
22.	63.4%	19.1%	59.1%	15.8%
29.	67.0%	19.6%	61.9%	16.2%
36.	69.1%	20.3%	64.1%	16.7%
43.	70.9%	20.8%	66.1%	17.3%
50.	72.3%	21.2%	67.5%	17.6%

It will be noticed that there is a great difference in the evaporation of the oils under high temperatures, and also in the extended test of fifty days. Under the fifty-day test, sub-

ject to a temperature of 120 degrees, the oil with a specific gravity of 1.055 lost 72.3 per cent of weight, while the oil with a gravity of 1.19 lost only 17.6. It must also be understood that a so-called creosote oil, with a specific gravity of 1.19 is an entirely different material from one with a specific gravity of 1.055; and it is questionable if, with the heavy oil, it is necessary to have the 50 per cent of resin or any at all. In fact, a great many engineers contend that the addition of the resin is injurious rather than beneficial. The object of the resin, theoretically, is as much, if not more, to preserve the creosote oil and maintain it in the blocks as it is to act as any preservative itself.

Referring to the different kinds of wood, the writer believes that it would be difficult to obtain an absorption of 3 per cent or less with any of the non-pitch woods with so small an amount of oil as 20 pounds per cubic foot. A sample of black gum that had been kept in an office, under the ordinary temperature, for a year or more, that had been treated with 40 pounds of oil per cubic foot, was tested for absorption, under the usual conditions, and absorbed less than two per cent of water.

All engineers will probably agree that the yellow pine wood of itself is the best material that can be used. But this material is growing scarcer and more expensive every year and the government officials have been making experiments for some years with the idea of obtaining other woods that would be equally as good, if possible. If, however, in order to get good results it is necessary to use more oil than with the pine, it might bring the cost of the cheaper woods equal to the cost of more expensive woods after both had been treated.

The 20 pound treatment will cost approximately 45 or 50 cents per square yard for the mixture, and if an additional 20 pounds are added, it, of course, increases the cost directly that amount. So that at the present prices, with the same treatment, black gum has an advantage over the yellow pine of about 45 cents per square yard. This difference, however,

might be more than overcome by the durability, or rather lack of durability of the wood under traffic. Black gum has been used to quite an extent recently in Boston but not long enough to obtain positive results.

After the proper treatment has been decided upon for the blocks, the question of how the engineers shall determine whether the specifications have been carried out or not is very important. It is a simple matter to see that the mixture has the proper specific gravity, and if resin is used, that the proper amount is added. The quantity of blocks put in the retort can be ascertained and the proper quantity of mixture used so that the blocks will average the proper quantity per cubic foot. Of course, it will be impossible to be sure that each block has the required amount. When it comes, however, to applying the absorption test and the weight of the block, if that be specified, another question comes up, that is, whether the blocks shall be tested at the works when they are just completed or at some subsequent time when delivered on the street, which may be some weeks or very probably, in some cases, months later. The contractors claim that the test should be made at the works, and if satisfactory, then they should be accepted at any time afterwards.

As the blocks are to be used in the streets for years, it would seem that they should be treated in such a way that they would stand the required test even if not used for several months after having been treated, especially if heavy oils have been used and in the light of the experiment noted above. The heaviest oil lost, approximately, 18 per cent after having been subjected to a temperature of 120 degrees for fifty days, which is an extremely severe test and one never possible to be reached on the street. If a block had been treated with 20 pounds per cubic foot and had lost 18 per cent, it would still have 16.4 pounds per cubic foot of the original mixture, which is more than the original requirements for the Minneapolis specifications. It would seem, therefore, to the writer, conclusive that

the blocks should conform to the specifications when delivered on the street and not when treated.

The requirement for sinking in water, which was inserted in the Brooklyn specifications, was used more to give a quick test than for anything else, and it was found that in the pine blocks, which were treated with a material that contained 50 per cent of creosote oil and 50 per cent of some other suitable material, almost every block that would sink in water would conform to the requirements in regard to absorption. This, however, in later experiments has not been found to be true, and in many cases blocks that would sink in water have not conformed to the absorption test. This may have been because the blocks, being heavier originally, did not take the treatment and absorb as much oil as the other blocks and that when immersed in water would absorb more water. This is wholly speculative, however.

The writer believes that the question of treating wood paving blocks is one that is being investigated more at the present time than any other one kind of pavement, as he has received many inquiries regarding it during the past season. He also believes that it is a matter that neither engineers nor contractors have any positive knowledge of at the present time, and thinks it of great importance that the different cities investigating the matter should in some way give each other the result of their different investigations so that in the end all cities might arrive at a good and satisfactory specification.

The question of testing the blocks is one of great importance, and it is absolutely necessary to arrive at some method of making the tests that will be as nearly positive as possible and perfectly satisfactory. And the object of writing this paper has been, not so much to give information as to seek it, and, if possible, to bring about the consummation above mentioned, that is, the getting together the ideas of the different engineers of the various cities and finally reach a result that will be satisfactory to all.

DISCUSSION.

MR. HOWARD: That is the best paper I have ever heard in my small experience on treatment of wooden block pavements, and I would like to venture to add only just a little. In 1884 I made my first investigation of wood block pavements, going to Paris, France, where there are several hundred miles of that pavement. The municipality owns the saw mills and the treating plants, and the work is all done by day labor. Those pavements were originally laid by contractors under an eighteen-year guarantee. The contractors not carrying out their agreement, the city took it over in 1885. Wood block pavements have been used in London since 1868 with increasing success. I saw the first block pavements under "Boss" Shepard go down in Washington and go to pieces. I will describe the successful wood block pavements of Europe. Woods used without treatment, the principal ones are the Karri and Jarrah from Australia. They are dense, might be called iron woods, very expensive in first cost, but more durable than granite as it is usually laid, because they do not fray or break. Next come creosoting methods. Next is the zinc-chloride methods. As you all know that keeps out the germs and keeps the wood from rotting, because all rotting is from germs. Next is the zinc-chloride glue tannin method. The great difficulty is in keeping the zinc-chloride in. The glue is used to keep the zinc-chloride in the wood, and the tannin combines with the rest and makes what is called leatheroid. You see it in chair covers and leatherettes. The method invented in 1838 by Bethell is known to us as ordinary creosoting. All his patents have elapsed long ago. The modified Bethell method for forcing the preservative in with air pressure is called the Rueping method. That was invented in Germany, and went all over Europe, to force the creosote in under air pressure. Those patents have elapsed. You can use that now to your heart's content. It was invented about 1869. Then the zinc-chloride-creosote method was used in Europe. Creosote being high in price, it is partially replaced by zinc-chloride which is cheaper. The latest London work is by the saccharine process, in which there is no pressure and no retort, and the blocks are simply boiled in two caldrons. Two plants will be erected in Canada. I think the agent of that process is here. It is patented. About a year ago I received blocks from London to test in my plant. I tested a lot of blocks of different kinds, carrying on comparative tests. The manner of treating, of course, is an important factor, but under it all lies the necessity for choosing good woods.

MR. KENDRICK: Is this additional weight of twenty pounds over and above the original weight of the wood? After it has been sterilized or steamed, as I understand it, it will lose a great amount of weight; in other words, I understand it will take up about twenty-four per cent in the block.

MR. TILLSON: If the original weight of the wood is 39 pounds, the treated wood should weigh 59.

MR. KENDRICK: As a matter of fact, in going through the cylinders, doesn't it lose a great deal of weight?

MR. TILLSON: If it did, that would be moisture and would have to be replaced. The idea was that the treated wood block should weigh 20 pounds more than the recognized specific gravity of the untreated wood.

MR. KENDRICK: I understand that. But in referring to it, you seemed to refer to block containing 20 pounds of creosote. It occurred to me you would really figure on 24 pounds.

MR. TILLSON: That may be, but it is the result I was specifying.

MR. DOW: I had some experience in inspecting black gum blocks in the Bronx that might be interesting to you. It was something new and they were treated under old time specifications, which required them to be dried at 285° F. before treating, and to contain 201 lbs. of oil per cu. ft. The gum appeared to be much more un-uniform than the pine, and while some of the blocks in the same treatment have absorbed 30 pounds, others in the same batch did not have 14 pounds. This was due to the amount of water in the block I tested. The green block vary from 16 to 56 per cent of water in the block. The treated block coming out of the cylinder practically all sink in water. After a few weeks of exposure to air 40 to 70 per cent sank in water, depending on the amount of exposure to air. The apparent un-uniformity of the gum was found to be due to the varying amounts of water contained; and the evaporation of this caused the loss of weight when exposed to air. As black gum wood blocks now manufactured are more or less air dried before treatment, they are much more uniform in treatment than those of last year.

MR. BROWN: I might add that I made some tests on yellow pine block to determine the conditions all the way through from the time the block was started through the process until it got through, and I found as he did, that the blocks did not get the full dose of oil. The reason for it in this particular case was that in the small experimental cylinder which I used for steaming the blocks I could not get the full pressure of steam, nor the full vacuum. After I found I could not get the weight, I finally tested after the steaming process, and I found that the blocks weighed more after the steaming process, by from about 3 to 6 pounds, than before, and the weight I obtained in the earlier blocks was shown to be partly water. There was not really as much of the oil in them as was shown by the weight. This difficulty is not found to be serious when the treatment is carried through on the large commercial scale where full pressure, vacuum and temperature are obtained.

FILLERS FOR BRICK PAVEMENTS.

A Recent Investigation of Various Bituminous Materials Used in Expansion Joints of Brick Pavements.

By William A. Howell, Engineer of Streets and Highways, Newark, N. J.

The first brick pavements laid in Newark were put down in the year 1895. In those days Newark simply followed the lead of other cities and filled the joints with cement grout, making no allowance whatever for expansion. This practice led to disastrous results on several brick streets, particularly so on Johnson avenue, where the longitudinal expansion of the Mack block pavement, one very hot day in the early summer of 1896, caused the pavement to buckle, or heave up from the concrete base, at the summit of two moderately steep grades, necessitating the relaying of about 500 square yards of pavement. That experience was an object lesson that opened the eyes of our people to the value of the expansion joint. Our specifications first called for filling the joints with tar every 50 feet, and at a later period every 25 feet, with continuous strips of tar or bituminous material in the gutters along the curbs. On one street, paved in 1896, every joint on a block containing about 4,000 square yards was filled with a tar preparation or paving pitch. Since 1899 our specifications have read practically as follows:

The contractor must provide a strip of wood, one and one-half inches thick and six inches wide, which must be placed along the curb stones and kept in place until the joints are grouted. Thereupon the strip of wood must be removed, and the void filled with paving pitch, of a quality described in a subsequent section of the specifications. The contractor must also fill joints contained within six row of bricks or blocks extending from curb to curb, every 25 feet, throughout the whole length of each block. The joints extending from curb to curb must not be less than

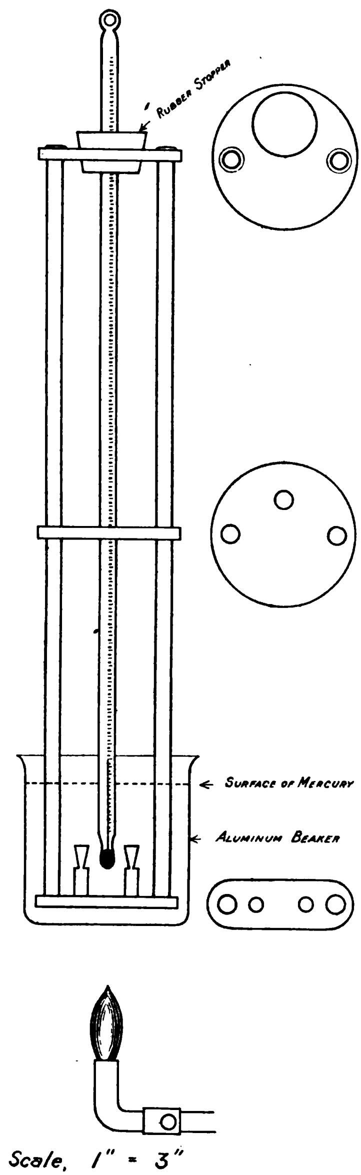
three-eights of an inch in width, which must be obtained by placing a strip of wood between the bricks if necessary or demanded by the engineer.

The joints between the six rows of bricks and along the curb stones, as above described, must be completely filled with paving pitch, which shall be composed of twenty (20) parts of approved refined asphalt, and three (3) parts of oil mixed with one hundred (100) parts of pitch, both obtained from a direct distillation of coal tar, and ordinarily numbered four (4) at the manufactory. The contractor must furnish the engineer with an affidavit from the manufacturer or refiner stating that the materials are the kinds specified. The preparation must be used at a temperature of not less than 300 degrees Fahrenheit when poured into the joints, which must be done with suitable implements, so that the paving pitch is not spilled over the bricks. The pouring must be done from the center to the sides. As the joints of the six rows are filled with paving pitch, fine and thoroughly dry sand must be sprinkled upon the filling of the joints, so that it combines with it. If required, the sand must be heated. The sand bed and the brick must be free from moisture before any filling is done.

Up to December 31, 1906, the City of Newark had laid 381,655 square yards of brick pavement (exclusive of brick gutters on Telford pavements) at a cost, exclusive of cost of advertising and inspection, of $917,064.72. This yardage represented a mileage of 19.94 miles of brick pavements. During the present year contracts have been awarded calling for the laying of brick pavements at an estimated cost of $430,753.24, making the total cost of brick pavements in the City of Newark to date about $1,350,000.00, exclusive of cost of advertising and inspection and also exclusive of the cost of brick gutter paving on Telford streets, of which we have in Newark over 50,000 square yards, laid at a cost of over $100,000.00. It has been apparent to the Engineering Department of Newark, and also to the Board of Public Works for some years, that there was great room for improvement in our expansion joints. We tried to procure, and we thought we had secured the best materials used by the most progressive and up to date communities in the country, but these materials did not seem to be able to resist the intense heat of summer. Inspection of streets, not only in Newark but in Greater New York, where the workmanship displayed was in other respects absolutely perfect,

showed the expansion joints from the crown to the gutter were empty, the bricks in the gutters were entirely covered with a coating of tar, averaging one-half inch in thickness, and extending from one to three feet from the curb. In view of these facts, and for the additional reason that it was very desirable to procure a more reliable tar preparation, to be used in connection with the tar and gravel filler on granite block pavements, our chief engineer, Mr. Morris R. Sherrerd, several months ago directed Dr. Justus Goslau, chemist in charge of the city laboratory, and the writer, to investigate most thoroughly the merits of every bituminous preparation known to be used for expansion joints in the leading cities of the United States and Canada. These tests were instituted about two months ago, and are still under way, but sufficient progress has been made to throw a flood of light on the subject. It has become apparent that the so-called No. 4 or No. 6 tar, while it may have its merits, will not answer in cities in our latitude, on account of its low melting point. On the other hand, tars which melt at a higher temperature than No. 4, and also improper mixtures of tar and asphalt, are too brittle in cold weather, and crack or contract, causing the bricks to lose their bond, with liability of chipping from traffic. The logical conclusion is that material must be used for expansion joints, avoiding both extremes. Dr. Goslau has devised the following test methods for determining the desirable or objectionable properties of the various bituminous grout materials. The tests referred to are the melting test, the flow test and a test for brittleness.

The melting test is made as follows, using apparatus shown on the accompanying sketch. Of the sample to be examined, two small pieces are taken, each weighing 0.2 of a gram. These are softened slightly with the fingers, and one laid around the head of each pin shown on the sketch, both pins having previously been slightly heated. The pins are then screwed into the base of the frame, and allowed to remain there to attain their original normal temperature. The frame is



APPARATUS FOR TESTING
BITUMINOUS FILLERS.

then placed in an aluminum beaker containing a sufficient quantity of mercury, so that the tops of the pins are one and one-quarter inches from the bottom of the beaker and one inch from the surface of the mercury. A low flame is then applied under the beaker, not over one inch long, with its tip one inch from the bottom of the beaker. The surface of the mercury must now be carefully watched and as soon as one of the pieces of bitumen strikes the surface, the temperature must be recorded. Should the second one strike the surface at a slightly higher temperature, the average of the two is recorded as the temperature at which the sample melts. Should the second piece make its appearance over five degrees Fahrenheit higher than the first one, the test must be repeated. (The bulb of the thermometer does not fall in the center of the frame, but the same distance from the sides of the cup as do the pins.)

The flow test is made as follows: A small pill weighing 0.2 of a gram is made of the sample to be tested and fastened on a glass plate about 7 inches by 8 inches in size, about one-half inch from the edge of the plate. The glass plate may be slightly heated before it receives the pill, but must be allowed to return to its normal temperature before making the test. The glass plate is next placed in an oven with a constant temperature of 125 degrees Fahrenheit, at an angle of exactly 45 degrees, with the pill fastened near the upper edge, and allowed to remain there for 24 hours. When more than one pill is placed on the glass plate they must be at least one and one-quarter inches apart .The plate is then removed, and the length of the flow measured in millimetres.

The test for brittleness is made as follows: Upon strips of tin, 4 inches by 2½ inches in size, an area or space of two inches by one-half inch is measured off in the center. The edges or limits of this space should be scratched into the tin with some sharp instrument. Into this space is placed 0.5 of a gram of the sample, which is then carefully melted and allowed to coat evenly the prescribed space of two inches by one-

half inch. A pointed glass rod may be used to distribute the material if necessary. The sample thus prepared is allowed to lie flat over night, then placed in water at a temperature of about 32 degrees Fahrenheit, containing pieces of ice, and allowed to remain there one hour. It is then taken out and quickly bent at an angle of 45 degrees. The brittleness is noticed at this point. Some substances will not crack at all, while others produce cracks of various lengths from very minute ones, to cracks the full width of the coating.

The results of these tests, on twelve samples of bituminous grout, have shown that a proper specification for such material, to be used in a city subjected to similar climatic changes as Newark, would be as follows:

(1) That the *Melting Test* be above 170 degrees Fahrenheit and that the material be either asphaltic or composed of a mixture of tar and some asphaltic substance.

(2) That the *Flow Test* be below 25 millimetres and that

(3) No cracks are produced by test for *Brittleness*.

The following table shows the results of twelve samples examined:

		Melting test. Degrees Fahr.	Flow test. Millimetres.	Brittleness test.
A	Asphaltic	212	.5	No cracks.
B	Asphaltic	206	1.0	No cracks.
C	Asphaltic	196	3.0	No cracks.
D	Asphaltic	178	11.5—	No cracks.
E	Asphaltic	174	20.5	No cracks.
F	Asphaltic	169	27.5	Cracks entire width.
G	Tar	149	101.0	Cracks entire width.
H	Tar	141	111.0	Cracks entire width.
I	Tar	124	120.0	Cracks entire width.
J	No. 4 Tar.................	118	134	No cracks.
K	Bermudez asphalt 10 parts. No. 4 Tar 90 parts........	122	128	Small cracks.
L	Bermudez asphalt 20 parts. No. 4 Tar 100 parts.......	126	123	Small cracks.

GOOD ASPHALT PAVEMENTS.

What Steps Should a City Take to Insure Them?

By Francis P. Smith, Consulting Engineer on Street Paving.

There are few problems submitted to a city engineer which are more complex or productive of more anxiety than is this one. He is asked to deal with a problem which involves not only engineering knowledge but chemical and physical knowledge as well. Even were he an engineer, chemist and physicist combined, he would find that such underlying principles as govern the process of laying an asphalt pavement must be applied with an ample fund of wide practical experience to render them of any value. If he endeavors to read up on the subject, he finds the literature that really tells him anything of value is very meagre indeed. He does not have to go very far into it to find out that much of it is more or less subtly contaminated with advertising claims and considerations for particular methods and brands. If he consults the representatives or publications of the various asphalt companies, he is furnished with an assortment of half truths or mis-statements, all tending to advertise these particular brands, and he finds that it would take many years devoted to this industry alone before he would be competent to pass judgment upon all the points connected with it. And yet he must prepare specifications and see that they are carried out.

A specification has a double function to perform. It must clearly describe and call for what is wanted and must bar out by its provisions that which is undesirable. In other words, it must call for a good asphalt pavement, describe the process and the materials to be used, and limit each so closely as to insure proper results. To do this properly calls for more than a passing acquaintance with the details of the process of manufacture, to say nothing of the refining processes to which the

asphalt must be submitted before it is fit for use in a pavement. Naturally he turns to other cities to see what they have done, perhaps not fully realizing that these very cities he turns to have acquired much, if not all of their information in a similar manner. There must have been a beginning somewhere to the endless chain and it is logical to trace it back to the beginning of the industry.

In the early days the sole source of information was from the contractors laying this kind of pavement and even these knew little of the true underlying principles. Also they were in business to make money, and one of the ways to secure contracts for yourself is to prevent your competitor from getting it. It is only natural that under such circumstances they should have endeavored to have inserted such provisions as would insure them as much of an advantage over their competitors as possible. This led to their advocating a meagre and limited description of the processes involved, as otherwise they would be divulging what was then a good deal of a secret process, and further, they endeavored to limit the kind of asphalt to be used to that which they more or less controlled. With such variations the same procedure is followed today and many of the provisions, still widely prevalent in modern specifications, are directly attributed to this cause and are still advocated as being necessary to secure the object in view, a good asphalt pavement.

This makes it doubly difficult to secure the truth and unbiased information really needed in order to draw up intelligent specifications from data accumulated by others or available from different sources.

This phase of the question has been briefly discussed in order to emphasize and make clear the difficulties encountered in securing part of the information necessary. Commercial conditions are held by many to justify the employment of so-called commercial methods, but without a full understanding of the conditions it is impossible to arrive at a correct conclusion.

It is far from the intention of the writer to cover or attempt to cover the whole art of laying an asphalt pavement in this paper, but a few fundamental principles must be touched upon in order to make the subject clear.

An asphalt pavement may be regarded as a flexible concrete, in which the binding material is asphalt or bitumen. Apart from the question of flexibility, the general problems involved in its preparation bear considerable resemblance to those connected with the preparation of an ordinary cement concrete. The mineral aggregate must be composed of such material as will insure the strength and proper stability. Each particle of the mineral aggregate must then be coated with the cementing material, and the whole mass finally compacted by tamping and rolling or other suitable means, and the process is completed.

I have termed this material a flexible concrete, and I think, justly so. At ordinary temperatures it is not rigid. Were it so, it would give a most insecure footing for horses, would polish or break up under traffic and be altogether unsuitable for a pavement. This very flexibility prevents the too rapid wear of the surface and the crushing of the sand grains of which it is composed and it is therefore a very important and essential property of the pavement under discussion. As the mineral aggregate possesses no flexibility in itself, this property must be secured by the use of a suitable cementing material, which will hold the particles together and yet permit them certain freedom of motion. The material, of which there are many varieties, commonly known as asphalt, is employed for this purpose. I am well aware that the term "asphalt" is one that is scarcely capable of exact definition. Many and long are the controversies that have been waged on this apparently inoffensive word, but nevertheless a pretty definite meaning has been assigned to it, in this country at least, as characterizing a hydrocarbon material, more or less pure, derived from natural sources, the pure bitumen of which is soluble in carbon di-sulphide.

All sorts of attempts have been made to classify the different kinds of commercial asphalts. Some are strong partizans of "God-made" asphalts, others advocate only their particular brand of this variety, while still others wax enthusiastic over the "man made" varieties. Some even go so far as to say that only "God-made" asphalt pavements (bituminous limestones and sandstones) should be used. On one point only is the opinion unanimous; there are good and bad asphalts and yours is usually bad and mine good. Dismissing these partizan claims, and none of them should be taken seriously, it should be clearly apparent that the value of the different varieties should be judged solely by their fitness to perform the functions required of them as indicated by their respective physical and chemical properties and regardless of the source from which they are obtained or the methods employed in their manufacture, except so far as these considerations aid in determining these very properties. If Portland cement were found in a natural state, what a time the cement manufacturers would have of it. No one decries glue as a cementing material because it is a manufactured product. None of the so-called natural asphalts are really suitable for use in their crude state. Nor should the fact that certain specific pavements, laid with any particular variety of asphalt, have not been successful, be considered as conclusive evidence against that particular asphalt. No asphalt in existence with which any considerable yardage of pavement has been laid, has a clear record in this respect. Local conditions, unskillful handling and many other considerations may have been the cause of the deterioration. All of us are probably familiar with certain limited investigations carried on by small towns who wish to experiment for themselves and test the comparative merit of different kinds of asphalt pavements. The test usually degenerated into a test of respective contractors instead of a test of pavements and frequently the poorest pavement, being laid by the best contractor, won out to the present satisfaction but ultimate disgust and heavy cost to the taxpayer. In limited examina-

tions and experiments of this kind, it is impossible to obtain sufficient data to permit of proper conclusions being drawn, and only by taking into consideration a sufficient number of cases to insure the throwing out of the accidental results in the final summary, can a true opinion be arrived at. This is really a very important point, as many a snap judgment has been formed on evidence of this very character and it is difficult for one not closely familiar with the business to judge of the character of the evidence submitted to him unless he has more time and determination to really get at the bottom facts than is usually the case.

Let us now consider in a general way what are the essential properties of our binding material. As one of its most important functions is to cement the sand grains together so as to insure sufficient cohesiveness as well as flexibility, it must evidently be cementitious. Not in the sense that glue is cementitious, for that ultimately dries out to a hard and only slightly flexible substance, possessing little or no ductility, but in the sense of being a very sticky, yet slightly fluid material. As the sand grains are to have a limited radius of movement, it must be sufficiently ductile to permit of this movement, without rupturing the cementing bond between them. These properties it must exhibit at the wide ranges of temperature to which a pavement is subjected and they must be permanent in order to insure a lasting pavement. Within the ordinary ranges of temperature, most asphalts used in paving possess the property of fluidity to a remarkable degree. While apparently so brittle at low temperatures that they will splinter and fly when struck a sharp blow, a lump maintained at this same temperature will gradually flatten out, and this is characteristic of these materials through a very wide range of temperature and up to a certain point is essential to their successful employment in an asphalt pavement. Unfortunately this fluidity becomes very marked in hot weather and yet to insure flexibility in winter, the asphalt must be kept soft at normal or average temperatures. In order to prevent the pavements from becoming too

soft in the summer, due to this property of the asphalt, great care must be taken in choosing the sand employed, and this will be treated of later.

On a heavy traffic street the sand grains are kept constantly in motion and the cementing material is subjected to constant kneading which tends to keep the "life" in the asphalt. As a rubber band, when laid aside, will quickly rot, but lasts much longer when in reasonable use, this kneading seems to be essential to the life of the asphalt in a pavement. Streets with little or no traffic on them soon harden and crack unless laid very soft and rich. In a rich pavement each sand grain is heavily coated with bitumen and a thick coat does not deteriorate so quickly in the manner above described as a thin one. With the ordinary fine-grained heavy-traffic mixture this would be very expensive and the pavement would become very soft owing to the ease with which the fine grains would move upon each other. The same object is obtained by using a coarser grade of sand. The surface to be covered is smaller, and without raising the percentage of bitumen in the mixture a much heavier coating is given to each grain and the increased size of the grains reduces their tendency to be displaced and so apparently hardens the pavement. It is much easier to displace a pile of sand than a pile of broken stone. These are extreme cases, but the distinction applies equally well to fine and coarse sand, except that it is in a lesser degree. Moreover the finer particles will be packed in between the coarser ones and this will tend to further limit the movement of the finer particles.

With the kneading of constant traffic the expansion and contraction caused by variations in temperature, and the stresses thereby produced, are more evenly distributed and this is partly compensated for in the lighter traffic streets by the heavier coating on each grain, which insures a larger amount of the flexible material at the point where the strain comes. It will be seen, therefore, that the required flexibility of an asphalt pavement is the consideration which greatly complicates the principles underlying its construction and differentiates it very markedly from the rigid type of concretes.

The necessity for a soft cementing material and the conditions necessarily resulting from its use, are not generally duly appreciated. Take for instance the case of a residence street laid in the early spring or late fall. When warm weather comes the pavement will mark up to a limited extent where horses or vehicles are allowed to stand. This is a necessary, and under no circumstances desirable condition, although frequently productive of much alarm to the property holder and many complaints to the city engineer. In the first place all good pavements mark under traffic in hot weather. They would not be flexible otherwise and would soon disintégrate and crack, especially in cold weather. As they grow older they mark less, due to better compression and the hardening of the asphalt cement. No amount of rolling by a steam roller ever gives a pavement its ultimate compression. While the total weight of the steam roller is great, the weight per square inch is much less than that of a heavily loaded wagon or the weight of a horse resting upon the caulks of its shoes. The kneading compression by moving traffic would be greater, even if the weight per square inch were the same, owing to the narrowness of the tires. Until a pavement has been subjected to reasonable traffic in hot weather it will never thoroughly compress and it will always mark up. On a light traffic residence street, as we have seen, the sand grains should be more richly coated with asphalt cement, and this again tends to increase marking of the pavement until it receives thorough compression. The very fact that the pavement does mark up proves that these same marks will be obliterated by other traffic and the street, which to the resident appears in such bad condition today, will have its marks almost wholly obliterated by the same agency that marked it up during the succeeding year. An asphalt cement whose tendency to soften under heat is not apparent, is either too hard to prevent cracking of the pavement in cold weather or too lacking in ductility to allow the necessary radius of movement to each sand grain without grave danger of breaking the cementing bond between it and its neighboring

grains. Rarely, if ever, has the writer seen a street which was really so soft as to endanger its usefulness as a pavement. The slight inconvenience apparent at first almost invariably adds to the life of the street and the objectors of today are usually the enthusiasts of five years hence.

In order to provide for the variations required by different conditions and the impossibility of securing an absolutely uniform asphalt, a flux is generally employed to soften the hard asphalt; the combination of the two being generally known as "asphalt cement"; and it is this combination which is added to the sand and dust to make the pavement. Another reason for the employment of the flux is that if the asphalt were refined so as to be soft enough to use in a pavement without fluxing, the barrels in which it is shipped would have to be of a much more substantial kind and correspondingly expensive.

The character of the flux to be used should evidently be carefully selected. It is usually employed in the proportions of from 15 to 25 pounds of flux to the 100 pounds of hard asphalt, or approximately from 1/7 to 1/5 of the asphalt cement is composed of it. Preferably it should be asphaltic in character, possessing the same cementitious properties as the asphalt itself, but this is not always possible or necessary so long as care is taken to choose a flux to combine with the asphalt used and produce the required properties in the asphalt cement formed. Owing to the various kinds of asphalt and fluxes used and the different properties of each, the writer does not believe it essential to specify very closely any particular requirements for the flux, believing that the requirements for the asphalt cement, if properly drawn up, will necessarily limit and determine the kinds of flux to be used. Certain unsuitable fluxes should of course be barred and the use of other kinds restricted to a limited amount, but different asphalts and different conditions present too wide variations to make specific provisions under this head of very much use.

This very question of fluxing serves to illustrate the onesidedness of certain arguments in favor of certain kinds of as-

phalts. Lack of uniformity of a product, so far as its hardness is concerned, has been used time and time again as an argument against it. Entirely apart from the merits of any particular asphalt or asphalts, it is true that some brands run more uniform in consistency than others, but of itself this does not mean that they are better asphalts, and no brand runs absolutely uniform. All of them require fluxing in some degree or other and no two deliveries of flux are ever the same; in fact the fluxes used are almost invariably made by the very same process that is so decried in the preparation of asphalt. Today the consistency of an asphalt cement is regulated by a penetration machine; an instrument which determines with accuracy its consistency. What matter it therefore, from this standpoint, whether ten or twenty pounds of flux per hundred be required today or tomorrow? True, with absolutely uniform asphalt and flux and method of heating, the same number of pounds of flux could always be added and no penetration machine would be required, but such conditions never exist and the argument quoted only involves the principle of degree and not of kind and, *per se*, has nothing to do with the quality of an asphalt as a cementing material. A careless or ignorant contractor may do better with the kind showing the least variation but that does not insure that he will not make other and more serious mistakes. Because one asphalt requires or does not require the use of a certain process to make it fit for use in paving, is no reason why the use or disuse of this particular process of refining should constitute an important, if not exclusive means of judging of the quality of an asphalt.

Whether an asphalt comes from this lake or that lake, or whether it is refined from a true asphaltic oil, has nothing to do with the question necessarily. Careless or improper manipulation will produce improper results, and improper material in any case can only be guarded against by rigid tests of the refined material, from whatever source, and a standard of requirements for each asphalt that will insure it being of the proper quality regardless of where it comes from.

There are about twenty pounds of pure bitumen in every square yard of the average two-inch asphalt pavement, costing from twenty to thirty cents, and this is by far the most expensive portion of the pavement. Sand and dust cost but little and the price in any one particular locality is pretty near the same to all. In a close competition, therefore, aside from labor costs, which with proper organization will not vary very much, any saving in the cost of the asphalt is an important item. From the city's standpoint this is a consideration to be carefully borne in mind. Substitution should be made impossible, and where the contractor also refines his own asphalt a particular brand, especially if a mixed product, may mean very little.

This does not mean that brands have no value. A reputable manufacturer should reap the benefit of honest endeavors to turn out a first class material. With a product as little understood as asphalt, this is doubly true. Inexperienced concerns with a limited output should or may prove disastrous from a city's standpoint. They may unwittingly turn out poor material from lack of proper knowledge or they may be unable to furnish the required quantity at the proper time, resulting in the complete stoppage of the work. Open and partly finished streets lying for weeks in an uncomplete condition and unfit for traffic is a possibility that no city engineer cares to invite. It is the old question of a purchaser choosing the concern capable of filling his orders. It is not always easy, with the base of supply thousands of miles distant, to investigate questions of this character and the object of the city engineer is to secure competition while safeguarding the city's interests. Therefore a specification admitting any and all asphalts possessing the necessary properties requires other safeguards based on commercial considerations. Here again misrepresentation is liable to enter the field and previous knowledge or close investigation is required in order that equitable yet necessary provisions may be made.

The general principles underlying the selection of the sand and filler which form the larger portion of an asphalt pave-

ment are not obscure or difficult to understand. The mineral aggregate must be compact to insure the best results, to make it tough and to keep the water from penetrating it. It must of itself possess stability to permit the use of a sufficiently soft asphalt cement without making the pavement too soft for traffic in summer. It must, therefore, have sufficient coarse grains to give it this stability and sufficient fine grains to fill up the interstices between the coarse grains, and again sufficient filler (fine stone dust) to fill up the smaller spaces between the finer grains.

The percentages of the different sized grains most suitable vary with the traffic conditions and any limits wide enough to cover all cases are too wide to be of much use in any specific instance. Different sands vary as to the amount of bitumen required to properly coat them, and each separate locality has, therefore, its own individual problem to work out in this regard and precedents in other cases may prove very misleading.

This has been amply proven by the experience of many thoroughly reliable and well equipped contractors, in new localities, where the different conditions presented resulted in the failure of their pavements until these conditions were thoroughly studied and understood. This means that besides a thorough knowledge of the general principles of the practice of laying asphalt pavements, a close study of local conditions must also be made, and in important cases these very local conditions have been carefully investigated for months by the scientific staff of some of the larger companies and many costly experiments conducted before success was finally obtained. Such minute and expensive investigations are of course only required in extreme cases and they are cited chiefly to demonstrate the necessity which always exists, in greater or less degree, for giving them due consideration.

The filler employed must be fine enough to fill the space between the finer sand grains and it must have the property of packing firmly when dry. When mixed in proper proportions with the sand, the mixture should be capable of being

packed into a stable compact mass offering considerable resistance to displacement and thus permitting the use of a soft cementing material. Portland cement or finely ground limestone are usually satisfactorily employed, depending upon the character of the traffic to be met, etc. Fine sand should not be used as it does not give the required stability to the mineral aggregate.

It should be evident from the foregoing that expert knowledge or close study is necessary before the first step towards insuring good asphalt pavements can be taken. The first step referred to is the step towards proper specifications. A contractor may lay good pavements under poor specifications or poor pavements under good specifications, but regardless of any other means employed, good specifications must be made to insure good results together with such other steps as should be necessary. Whether the expert knowledge be purchased or acquired is immaterial from this standpoint, but this at least is certain, it can only be acquired by long years of experience and close study and personal intimate contact and investigation of all the processes involved, both chemical and physical. Even then, it will be limited unless it covers a wide range of country and conditions, and this is plainly shown by the many cases where men having a superficial knowledge were successful in laying pavements in a certain locality and failed utterly when they conducted their operations in other cities.

Let us assume that, in one way or another, proper specifications have been prepared or secured (and there are few, indeed, that could not be improved upon), what steps must be taken then to see that they are properly carried out. Two methods have been tried; inspection and a guarantee clause. The guarantee clause has been already discussed at this convention, and I will not go into it further than to say that as a means to insure good pavements it has been found inadequate. Inspection then seems the last resort, but present methods of inspection are very faulty, indeed. First, the material used must be inspected. This involves chemical and physical examination

of them. Let us assume that a particular brand of asphalt has been bid upon and accepted for use. Not only must identity of the material examined be determined, but also whether it is up to the standard of this particular variety or brand. Without a large experience in this kind of work the average chemist is unable to satisfactorily determine this. It is a special line of work and requires a specialist in that line to insure proper results. The mere results of an analysis will not give the city engineer the desired information. He is not in a position to know the normal variations in bitumen or any other constituent in the various kinds of asphalt admitted for use. This information must almost always be in the possession of the man who makes the examination. This is one of the points which the establishment of a city laboratory under the direction of any one not familiar with the paving business fails to provide for. Such a laboratory may and does have a moral effect upon the smaller and less experienced contractor who has no such equipment of his own, but fails lamentably where it is confronted or opposed or evaded by the fully equipped laboratory of the larger contractor in charge of the expert who thoroughly understands his business. The same thing is true respecting the analysis of a sample of the paving mixture being laid.

What really useful information does a city engineer obtain from a report of an analysis of a surface mixture showing the percentage of bitumen and the various sizes of sand grains it contains? If there is a bitumen limit in his specifications he can of course determine if this is being complied with, but without a thorough knowledge of the subject he would not be in a position to criticise the mixture or order it changed from the results of the analysis submitted to him. Realizing this, a contractor could successfully oppose his attempts to regulate or improve the character of the mixture being laid by these means and the city engineer would not care to assume the responsibility which might at the same time vitiate his guarantee clause unless he was very sure of the ground that he was taking. Such analytical records as those referred to, if properly

tabulated and preserved, would be very valuable data for future study after the lapse of sufficient time to prove the character of the pavement represented, but this would take a number of years and more close study of the subject than the average city engineer has at his disposal. While the establishment of a city laboratory is a step in the right direction, unless it is in the charge of a paving expert it will be years before the results obtained will be anything but negative in character, and the recognition of this fact has led to the adoption of this very plan by the City of Washington, D. C., where the inspector in charge is required to be a trained chemist and at the same time fully familiar with the laying of asphalt pavements. Not only is the testing of the pavement and the materials entering into its composition done by him, but he has actual charge of the inspection of the work as well and knows how to regulate its performance by means of the laboratory examinations conducted by him or under his direction, and from time to time he suggests such changes in the specifications as may appear to be necessary or desirable.

Street inspection is good and to a certain extent necessary. It does not require any very great knowledge of the asphalt business in order to be productive of good results. With ordinary intelligence the necessary knowledge will soon be acquired and compliance with the provisions of the specifications insisted upon. This is by far the least important part of the inspection, however. Improper manipulation of the mixtures on the street may lead to poor results; and although this has been guarded against, no steps have meanwhile been taken to insure the quality of the mixture as made at the plant. A poor mixture turned out at the plant cannot make a good pavement, no matter how severe the inspection on the street. And yet modern methods of inspection always leave the plant without any competent supervision. This is probably due to the fact that an inspector, to be of any use at this point, must be familiar with the business; but this is hardly sufficient reason for not giving it the consideration it should receive.

Analyses of the pavement will reveal some, at least, of the defects. If promptly done and the results properly interpreted, future mistakes may be guarded against, but much may be done at the plant that has immediate results. The proper grading of the sand can be insisted upon and maintained, overheating avoided, proper proportions of the ingredients maintained, the consistency of the asphalt cement carefully regulated, and, in short, a good mixture insured.

Theoretically it is no part of the duties of the city engineer to instruct a competent contractor how to conduct his business, but it is oftimes much to his advantage to be able to do so.

Such a method of inspection would command the respect of the contractor, who would soon learn that he was aided by it to secure the best results and his future expenditures for repairs thereby reduced. The trick contractor would be kept straight and the inefficient one provided with the necessary information to secure the best results.

The only solution of the problem contained in the title of this article would seem to be the preparation of specifications that really specify and an inspection system that fully covers both the manufacture and the laying of the pavement, in charge of some one whose experience renders him competent to really direct operations, and, if need be, take charge of them himself in the interest of the city. Even with a municipal plant the same problem of turning out a proper mixture is involved and a competent yard foreman is not, and should not be regarded as an expert in the true and necessary sense, in a case where so many qualifications are essential to a true grasp and understanding of the problems involved.

SOME EFFORTS BEING MADE TO IMPROVE THE ASPHALT PAVEMENTS IN KANSAS CITY.

By E. A. Harper, City Engineer.

Kansas City has been laying asphalt pavement for twenty years past with more or less indifferent success, the earlier pavements giving better results than those laid within the last five years. These earlier pavements were laid with a 2½-inch top, using some 8 to 9 per cent of bitumen, and a more or less indifferent sand grading, but producing a hard mixture. This pavement held a firm, even surface, but developed a tendency to crack. To overcome this, more bitumen was added, without considering sand grading or filler, producing a pavement that showed a tendency to creep under travel. The companies then reduced the thickness of the top, and provided a 1½-inch binder. This last move did not entirely overcome the tendency to creep, and for a number of years we have been troubled with wavy and irregular surfaces which travel tends to increase from year to year until holes appear, or the surface is forced from the crowns of the street into the gutters.

Up to 1898 the companies guaranteed the pavements for a period of five years, and at that time the guarantee was increased to ten years without adding any to the real life of the pavement; in fact we have had more trouble with the pavements laid under the long guarantee than with some of the earlier pavements laid. Realizing that the guarantee does not add to the life of the pavement, and considering the difficulty encountered in our efforts to force the companies to keep these same pavements in first class repair, the city decided it better policy to establish a testing laboratory and a corps of competent inspectors and satisfy ourselves that we were getting the best possible pavement that could be laid, irrespective of the guarantee by paving companies, which did not necessarily

mean a first class pavement. While these companies did not deliberately lay poor pavements, their methods were crude and unscientific. They employed no chemist at the plant, but depended rather upon the skill of a practical foreman. This man knew how many parts by weight were necessary to make a surface mixture. He did not know how to improve the condition where faults appeared, and so perpetuated blunders. A fair sample of his work was discovered shortly after our testing equipment was put into successful operation. The company had had considerable trouble with their pavements cracking, and to overcome this they added more asphaltic cement, producing a surface mixture that was extremely soft in summer, making a very poor appearing piece of work and bringing about endless complaints. The specifications used in buying materials were high grade, but as they had no chemist, these were accepted on faith. We were forced to condemn about the first tank of flux we tested, after getting our laboratory in working order. It contained about 5 per cent of water, and some 18 per cent of matter that volatilized when heated for seven hours at 325 degrees Fahrenheit. This in itself was sufficient to account for the cracking of the pavement. The specifications used in the past were prepared by the asphalt companies, and entire dependence was placed on the skill of the company and their guarantee. As soon as we became more familiar with the processes and the needs that go to make a first class pavement, we prepared new specifications along more scientifice lines and based upon the best experiences we were able to consult.

The companies bidding are required to furnish samples of the flux and asphaltic cement. This flux must contain no water, must not flash below 300 degrees Fahrenheit, and must not volatilize more than 5 per cent when heated for seven hours at 325 degrees Fahrenheit.

The asphaltic cement must not flash below 350 degrees Fahrenheit, must contain no water, must not show more than 4 per cent loss in weight on being heated seven hours at 325 degrees

Fahrenheit, and must not show a loss of more than 8½ per cent in weight on being heated for seven hours at 400 degrees Fahrenheit. It must not contain more than 4½ per cent of carbonaceous matter insoluble in carbon bisulphide, and must not show more than 15 per cent of fixed carbon, and must not contain more than 3 per cent of parrafin scale.

Our inspectors in the field test the loads as delivered with a thermometer and condemn when under 250 degrees Fahrenheit, or over 375 degrees Fahrenheit. Samples from about every eight loads are taken and tested for paper stain. These samples are sent to the office and tested for bitumen and sand grading. A record is kept of all these tests for future study, and a copy is sent to the various companies doing the paving, calling their attention to any variation from the standard mix. The plants are visited every day and samples of asphalt and flux taken and checked to see that they come up to the samples furnished with each bid.

We had considerable trouble in getting the companies to furnish satisfactory sand, they claiming that it was impossible to get a proper sand in this vicinity; but after visiting the various sand supplies we finally found a combination of sand from three different localities that produced an almost perfect mixture.

The next thing to be corrected was the foundation material. Most of the pavements laid in the past are upon a natural cement foundation, which was not overly strong, and very porous, and many of the pavements are laid upon old macadam roads. The first necessity for first class pavement is an unyielding, waterproof foundation. We had to educate the public and the city fathers to our way of thinking, and to overcome the strong lobby interested in the natural cement, and we have at last reached the place where nothing but good portland cement foundations are used. After the foundation and proper sand grading, comes careful and continuous rolling. The more compact and dense the surface, the more durable and perfect in appearance, and the less the likelihood to creep. We require

that all surfaces shall be rolled with a 10-ton roller, not only lengthwise but crosswise, for at least five hours for every thousand square yards of surface. Eternal vigilance is the price of a good asphalt pavement.

We have been departing somewhat from the old beaten path of natural mineral asphalts; whether wisely or not, only the future will tell. Combinations of Texas or Southern Kansas asphalts, and California or Utah asphalt seem to give very good results. I see no reason why, if carefully prepared, the artificial or residum asphalts should not give as good results as the natural. The Texas asphalts have this good quality, that they are less susceptible to changes of temperature than some of the natural asphalts, so will probably stand without injury a larger percentage of parrafin scale than allowed under our specifications.

DISCUSSION.

MR. FOLWELL: I rise not to add information but to seek it. I was wondering whether Mr. Dow could give me the information as to just when the injurious effect of the paraffine scale is on the asphalt to which he refers, and why the Texas asphalt could stand a larger percentage of that than the other asphalts.

MR. DOW: As to your first question, about the injurious effect of the paraffine scale, most people imagine that it makes the asphalt susceptible to changes in temperature, but that is not correct. It doesn't make it susceptible to change in temperature. It does, however, make it waxy and lacking in adhesiveness. In regard to the Texas asphalt standing more scale, I believe the contrary to be the case. I am not a believer in the Texas residuums at all as yet, although I have done a great deal of work on these materials endeavoring to make them into suitable paving cements. I believe the paraffine scale to be one of the objections to the Texas materials, and that the larger the quantity they contain the poorer their quality.

BACKFILLING TRENCHES.

By George C. Warren, President Warren Bros. Co., Boston, Mass.

It is pleasing to note that recent issues of engineering periodicals have devoted prominent space to the matter of backfilling trenches, which is both one of the most important and one of the most neglected matters which municipal officials and contractors have to consider in connection with street work.

One of the articles referred to quotes from specifications of the West Park Commissioners of Chicago, which are incorporated in permits granted for making excavations in streets to reach underground service pipes. From the quotation, the following extract is of special interest:

> All material excavated from any trench under paved roadways must be removed from the boulevard; said trenches being refilled with clean cinders, sand, gravel, or crushed stone, placed in layers not exceeding six inches in depth, thoroughly compacted with heavy hand rammers, using the necessary amount of water to complete perfect consolidation of the backfilling.

This specification is on the safe side, but for general use it seems unnecessarily severe and expensive in its requirement that all material excavated from any trench must be removed from the street and replaced by cinders, sand, gravel, crushed stone, etc.

I refer to the removal of excavated material from the street regardless of location of work or character of material "excavated from any trench." In the case of West Chicago park boulevards, such a general stipulation may be justified by either:

(1) The importance of not littering the boulevards any more than absolutely necessary; or

(2) The knowledge, if it is a fact, that the sub-soil underlying this section of Chicago is such that after being once dis-

turbed, it is unsuitable for backfilling of trenches. Whatever may be the reason and justification for such a claim by the Chicago West Park Commission (probably justified there), this is not a provision generally suitable for all cities and all classes of sub-soil. I do not want to be understood as advocating withdrawal of the greatest precaution and care in the important matter of backfilling of trenches, carelessness in which is costing hundreds of thousands of dollars annually in damage to pavements and to vehicles. My purpose is to point out the importance of the matter and to suggest practicable, general requirements for overcoming the difficulty in the most economical way in each particular case.

With a quarter of a century of experience in street paving throughout the United States and Canada, I believe I have met the matter of backfilling of trenches in about all of its possible phases, and I appreciate the fact that it is most difficult to draft a specification which will give:

Efficient results and a basis of payment which will insure the greatest economy to the city and fairness to the contractor.

The greatest difficulty is that the method of treatment and its cost vary widely with the character of sub-soil, which often varies greatly within the limits of a single sewer or water or gas pipe trench. This cannot often be foreseen and it often varies with the weather conditions (wet or dry) which happen to prevail.

Before attempting to offer a solution I will mention a few instances known to me. There is a popular notion that a trench should be allowed to settle for a year before paving and that then it is safe. This is not only a fallacy which breeds carelessness in cases where it is thought no pavement will be laid in a year or more, but it is impracticable to defer paving a year or more after all mains and house connections are made and equally impracticable to avoid cutting into pavement for installation of and repairs to service pipes. We all know that, by careless or indifferent backfilling of trenches, unpaved streets are often rendered dangerous and nearly impassable for years.

I remember about fifteen years ago an instance in one of our older cities where an asphalt pavement was being laid to replace an old cobble pavement. The cobbles and a few inches of the underlying earth necessary to provide the sub-grade were removed; the sub-grade rolled with steam roller and concrete foundation was laid. While the concrete was setting there was a good deal of rain. At one point in the street the concrete settled and developed a hole into which a hoe handle was inserted the full length without finding the bottom of the hole. Investigation and subsequent examination developed a serious hollow several feet deep about two feet below the surface and over two hundred feet long, over a sewer which had been laid twenty-five years before and doubtless backfilled in the generally customary way of merely throwing the earth loosely back into the trench. In this case a crust or arch of solid earth had formed which did not develop the hollow below until the excavation for the new pavement removed a part of this crust and the rains caused the balance of the crust, in one spot, to fall into the hole.

In another instance no trouble developed in the construction of an asphalt pavement laid on concrete foundation, but three years later a horse's hoof broke through the surface of the pavement and he broke his leg. Examination revealed a hole six feet deep, which it took fifty loads of earth to fill, over a sewer trench ten years old. It is very common for a pavement to settle a year or more after laying it over a sewer trench, filled several years before the pavement, where no trouble developed during the rolling and laying of the pavement. It is still more common to find almost insurmountable difficulty, while the paving is in progress, from settlement of old trenches.

So much for the theory that however carefully a trench or other fill is made it will settle itself within a year. On the other hand, I have never known of a case where trouble has followed from the settlement of sewer or service pipe trenches made immediately before the laying of the pavement where I

had supervision of the backfilling, even with treacherous soil conditions. I would rather guarantee a pavement laid immediately after a sewer trench, the filling of which I could control, than five years after the laying of a sewer, the trench of which was filled with the generally customary carelessness and usual view only to least possible cost.

About two years ago I was going over a street about two miles long in the middle west, for the paving of which bids were about to be received. A sewer, the trench of which was from 15 to 20 feet deep in a clay soil, was being built, using an excavating machine which backfilled without tamping. On account of the looseness of the fill the level of the roadway over the trench was being raised about 18 inches, sloping to near the edge of the road. An inspector was standing over the work and I asked him to show me the specifications. They clearly provided for "thorough tamping of the trench in courses of not more than 6 inches." On calling the inspector's attention to the provision, he first claimed that it only referred to paved streets. I showed clearly that this was not the case and explained that my interest in the matter was as a bidder and possible contractor for the pavement to follow, and received the following retort: "You don't shuppose Misther Murphy (naming the contractor) is going to fill the sewer for youse." The outlet of the same sewer passed through a paved street which I found was actually being filled from tip carts loaded from the excavation by buckets and hoisting engine and without any tamping whatever. An appeal to the engineer brought a promise to investigate. A continuation of the trouble and further inquiry brought out the explanation that this provision of the specifications was not generally complied with; that contractors did not figure on doing so, and that it would be a hardship to force him to the expense, and that as the pavement would not be laid for a year, the trench would probably be settled by that time. This is only a somewhat aggravated case of what happens in fully three-fourths of the sewer trenches which are made.

Now, for the remedy, which is more difficult than to call attention to the common faults.

In the case of permits to service corporations, plumbers and property owners, to cut into the streets, whether paved or unpaved (the former is but little more important than the latter), it is necessary only to stipulate in the permit that "the trenches shall be backfilled by such means as the city engineer may direct, depending on the character of the excavated material, in such a manner that all excavated material shall be replaced in the trench without raising the grade of the roadway. Flushing will only be permitted in cases where the sub-soil is sand or gravel or other material from which the surplus water will readily drain away, and in the case of concrete or brick or pipe sewers, the joints of which have been made water-tight with bituminous pipe-jointing cement."

A prominent contractor who has had a large experience in sewer construction and one who takes the greatest care in the execution of his work, has recently written me as follows:

> In pipe sewers, no puddling of ditches should ever be allowed, for it is impossible to prevent the water from getting through the joints of the sewer pipe, and it is very likely to cause settlement in your pipe, thus breaking your cement joints. Some twenty odd years ago, in Somerville, Mass., I took the most extreme pains in having joints cemented, leaving a stretch of ditch for some few hundred feet open until the cement had thoroughly set. I personally examined every joint to see that it was a good job. We then filled the ditch, and after it was about half filled the water was turned into the ditch from a hydrant. In a short time the 8-inch sewer pipe at the manhole at the lower end was running half full.

In criticism of this proposed requirement "to get back all the earth excavated from the trench," reference may be made to the volume of the pipe. My reply is that, except in trunk sewers (which do not apply to permits referred to), the volume of the pipe is so little in comparison to the volume of the trench as to be insignificant. It is well known that more earth can be tamped into a trench than is removed from it. In my judgment the only case where the rule of "get back all the dirt" cannot apply is in rock excavation, in which case the breaking up of the rock nearly doubles its volume and the

particles of rock are so large that they cannot be replaced to their original density.

In the case of contract work for sewers, etc., the case is more difficult in view of the necessary uncertainty of conditions to be met under ground, and consequent uncertainty of the most economical way to properly "backfill" the trench and consequent impracticability of the contractor accurately figuring in advance what the cost "per lineal foot" will be. On this account some contractors are sure to bid far too low to permit proper work. Others figure "safe" with the probability that if they receive the contract, the total price will be too much above the estimated cost. In one case the city has the almost impossible task of forcing the contractors to do proper work at a loss. In the other case the city will pay too much for the work. An effort should be made to avoid both evils.

My suggestion is to apportion the prices in such a way that whatever material is encountered a fair price will be allowed the contractor for each, as follows:

(a) Furnishing and setting pipes per lineal foot.

(b) Earth excavation per lineal foot (providing for varying prices for varying depths of sewer).

(c) Rock excavation per lineal foot (providing for varying prices for varying depths of sewer).

(d) Hauling excavated material to spoil bank, if unsuitable for backfilling, and its removal directed by the engineer, per cubic yard.

(e) Lumber delivered on work, if any is required for shoring, per M. B. M.

(f) Placing and replacing, if lumber re-used, in sewer trench per M. B. M.

(g) Refilling trench if backfilled by flushing earth excavated from trench per cubic yard.

(h) Refilling trench if backfilled by tamping earth excavated from trench per cubic yard.

(i) Refilling trench if backfilled by flushing suitable borrowed material, to replace unsuitable excavated material

drawn to spoil bank by order of engineer, including furnishing the material, per cubic yard measured in the wagons as material is delivered.

(j) Refilling the trench if backfilled by tamping suitable borrowed material (conditions the same as item "i") per cubic yard.

(k) Refilling trench with rock excavated from the trench per cubic yard.

Corresponding with such a schedule of prices in proposal and contract, the specifications should provide as follows:

1st. Material excavated from the trench, which in the opinion of the engineer is unsuitable for backfilling, shall be hauled by the contractor to a spoil bank and shall be paid for at the price bid per cubic yard for "hauling excavation to spoil bank," measurement to be made in the wagons at point where loaded.

2nd. Flushing in backfilling will be permitted only in case the material is sand or gravel or other material, from which in the opinion of the engineer the surplus water will readily drain away and leave the earth filled solid.

3rd. Except where flushing is directed by the engineer, the backfilling shall be done by thorough, hand tamping in layers not exceeding six (6) inches in depth. Flushing will not be permitted except in cases of brick or concrete sewers or of pipe sewers, the joints of which have been made water-tight with bituminous pipe-jointing cement.

4th. Whether backfilling of earth is done by flushing or by tamping, the full amount of material excavated from the trench less the volume of the sewer shall be refilled into the trench without raising the grade.

5th. In case rock is excavated from the trench, it shall be backfilled by carefully placing the excavated rock in layers with succeeding layers of earth well flushed into the voids between the pieces of placed rock.

6th. In case the excavated material is clay, which in the opinion of the engineer, is too wet to enable solid backfilling by

tamping, the excavated wet clay and reasonably dry "borrowed" earth shall be tamped into the trench in succeeding layers, using enough of the dry earth to overcome the excess of water in the clay and to provide a solidly filled trench to the satisfaction of the engineer. The "borrowed" earth, including tamping, to be paid for per cubic yard of "borrowed material" tamped into the trench. Measurement of the borrowed material is to be made in the wagons as delivered on the work.

If any one thinks these requirements are complicated, the answer is that the conditions are necessarily complicated. No one can tell in advance the conditions of materials to be excavated and the treatment they should receive in backfilling. The simple and incomplete specifications and the method of payment generally adopted in the past, has resulted in general unsatisfactory results. Requirements should be provided which will correct the evil of poorly filled trenches, however complicated they at first appear.

Of course it must be expected that the cost of efficient and proper backfilling of trenches will be much greater than the cost of the inefficient system generally in vogue. The increased cost will be nothing compared with the saving in repairs to road surfaces and vehicles.

A prominent engineering paper which makes a specialty of earth work recently published a series of tables of interesting and complete cost data, collected and tabulated with great care. One report of twenty-six jobs on sewer sections in one city aggregating 8,882 lineal feet, shows an average cost of backfilling the trenches of .0722 per cubic yard. The soil is generally reported as good clay and that backfilling was done by hand shovels. It is well known that this is a very low average cost of bare shovelling of earth under the most favorable conditions, so that the backfilling must have consisted of loose shovelling of the earth into the trench. What about the condition of the roadway, whether paved or unpaved, following this shoddy work and what about the vehicles which have to

pass over nearly two miles of this street during the next few years?

Referring to the provision above for paying for the excavation of sewers per lineal foot, with varying prices for varying depths of sewer, it will be appreciated that at depths exceeding eight feet the cost of excavation in sewer trenches per cubic yard increases very rapidly. With varying depths and widths of trenches requires quite complicated calculations to estimate the number of cubic yards of material excavated. The suggestion, therefore, is made for paying for excavation per lineal foot of sewer of each size and of each depth. If, therefore, the sewer has varying depths and varying sizes of pipe, not only should separate prices per lineal foot be taken for each size of pipe, but also for each increase over eight feet per foot of depth of sewer. This method of payment for the excavation or trenching not only overcomes the necessity on the part of the engineer of complicated calculations of the amount of earth excavated and consequent general delay in payment for the work, but it also removes all possible dispute between the contractor and the engineer in case the plans are changed, either increasing or decreasing the depth of sewer, which changes are often made necessary. If, as is the general custom, payment for excavation or trenching is paid for either per lineal foot or per cubic yard, without reference to the depth, the contractor can justly complain if the depth is increased, and will be sure to do so on the ground that not only is the amount of work being increased but the cost per cubic yard of earth removed is being increased, by reason of the increased depth. With this condition and no provision in the contract for variation of prices to meet the condition, there is pretty sure to be a dispute between the contractor and the engineer as to the proper method of payment for the additional work. An important feature in all contract work is to, as far as possible, provide a unit of price in the contract for each contingency which may arise.

An important point, not referred to above in connection with repaving over sewer trenches on paved streets, is the

matter of foundation. Even with the greatest care in backfilling a trench, it should be reinforced at the top by a solid Portland cement concrete foundation for the pavement. The concrete should extend over the edges of the trench about six inches on each side.

One engineering journal recently suggested that tamping the earth in backfilling trenches be done with pneumatic or steam rammer. This offers food for thought to the inventor. For the present tamping must be done by hand. The common bad practice, where there is even a pretense of tamping, is four to six shovellers to one tamper, with the weakest man in the trench because his work doesn't count in the amount of trench backfilled. A good rule is to put two men with heavy rammers in the trench for each shoveller outside. Put the best men at tamping and satisfactory results will follow, if accompanied by proper supervision.

DISCUSSION.

MR. HOWARD: I can point to about $450,000.00 worth of paving in New Orleans. La., where, in trenches, on both sides of Canal street, were laid double lines of pipes, and the dirt was simply shoveled back loosely into the trenches, and the water run on. That was done in 1905. I went back to New Orleans on other matters in 1906, and I went over to Canal street, and went along it from somewhere a little back of Charles street, clear out to the cemetery. I went there with the feeling that it would have settled, and I found it had settled. Fortunately for the paving man, there was a clause there that the men who had put in those two lines of pipe were responsible for the settlings, and the matter is being adjusted in New Orleans now. I think this is an admirable paper, and it gives suggestions which I am sure the Society will be glad to consider.

MR. ANDREWS: This paper seems to me of greatest value, and I heartily endorse what the writer says about water flushing of trenches. Another point he speaks of is as to these great cavities. It seems to me they could hardly be due to the settling of the earth. The earth must have gone into the sewer to make such a cavity as that, and that is another point he covers very well in his paper. I have seen—I suppose most of us

have—great cavities of that sort in the pavements, where there is no doubt that the dirt has gone into the sewers, especially if the sewers were old and full of holes.

Mr. Folwell: In reference to the settling of trenches, I do not know that I can agree with Mr. Andrews that the earth must have gone into the sewer. Take ordinary soil, where the dirt had simply been shoveled back into the trench and had not been tamped, we would expect in a few months that it would settle probably a foot in certain soils from moisture, from the rain, etc., the earth gradually settling down, and this where there is no question of the earth getting into the pipe, as where iron pipe is laid. Take a clay soil and put the clay back into the trench and if it is on a busy street and the teams go over it constantly, you will get the arch Mr. Warren has referred to. Now this can be reached by moisture drawn by capillary attraction from either side, and that soil will settle ultimately as much as if this arch were not there. The arch doesn't settle and we have this cavity. I have myself crawled for over 100 feet underneath such an arch in a town in central New York, and that arch had been there for fifteen years under a busy street, and no one would have known it was there had it not been that, in excavating for a sewer, it was discovered. I was a young fellow, and out of curiosity I crawled under that and went 100 feet through it. Another thing. Mr. Warren spoke in his specifications concerning making tight sewer joints, so that water would not wash into them in water-tamping the trench. I made it a practice, in working in towns where I knew there was much ground water, and where I knew the pipe would be subjected to the pressure of ground water, to test the pipe by building a block at a time, putting up a dam of earth at the lower end and allowing the water to collect in the trench over the pipe until there were two or three feet of water in the trench; then if a joint leaked the contractor must fix that joint before he was allowed to throw the dirt back into the trench and backfill it. And one more experience—as Mr. Andrews said so well last year, in regard to the danger of backfilling by flushing in certain conditions of soil; I recall one condition when I backfilled a trench with water and two weeks after it the contractor had to go up there with a derrick and pull a horse out of the trench. The dirt was so soft that the horse got in, and could be gotten out only by the use of a derrick.

STREET PAVING AND CLEANING.

Notes on the Year's Progress. Report of Committee on Review.

By Clarence D. Pollock, Engineer, Bureau of Highways, New York.

As usual, progress has been made in street paving, street cleaning and final disposition of city wastes.

Whether the increase in mileage of improved pavements will equal or exceed previous record years or not, we cannot tell until the records for the full year are compiled. However, it would not be surprising if the length of new pavements should be less than that laid in previous years as a number of our large cities have been handicapped by failure to sell bonds for improvements—for example New York and Boston.

Some cities have given more attention to the repair and maintenance of existing pavements which seems to be a move in the right direction,—there is such a thing as rushing ahead, spending all of a city's money in new pavements, and often cheap pavements, and not keeping the older ones in passable repair, until a city becomes, like some land owners, "land poor," or in this case, "pavement poor," *i. e.,* cannot pay the taxes, which here is the cost of maintenance.

The number of municipal asphalt plants, especially those for maintenance work, has been augmented. This, too, is along the right track. Even though it may cost somewhat more for a city to repair its own asphalt pavements, as is often argued, it would seem worth a considerable extra cost for the municipality to have complete control of the repair machinery and thus be in a position to see that all holes and openings are repaved promptly, no matter how far from the plant. Thus many damage suits may be averted and also, by no means least, the taxpayers will have full use of the pavement for its full width all the time.

Numerous cities and towns have continued experimenting with various preparations for laying the dust and preventing dust on macadam pavements. In general the cost of these methods, or rather of those which seem to accomplish the result aimed at, is apparently as great or greater than the cost of sprinkling with water; however there is the advantage of having the dust prevented at all times, while sprinkling only lays the dust during the daytime or while the sprinkling is continued. Many complaints are heard of the destruction of macadam pavements by the speeding automobiles, and attempts have been made to secure a solution or compound which may be applied to the macadam to lay the dust and at the same time to harden the surface and prevent this wear. There appears to be abundance of room for experiment on this subject.

It is encouraging to note that more portions of the country are giving up the old method of working out road taxes and are paying them in cash. This enables the town, county or state to employ men of experience to direct and superintend road improvements, and also to lay out a general system for the work.

A recently published report of data collected by the United States Office of Public Roads of the Department of Agriculture furnishes good food for thought. Mr. L. W. Page, the director of this bureau, has displayed a great deal of energy and care in compiling this report.

Among other things he shows that in 1904 there were 2,161,570 miles of public roads in the United States, and of these 7.14 per cent were improved in some shape. These are outside of towns and cities. He shows 0.73 miles of road to each square mile of territory, or 1 mile of road to each 35 people. The number of people to the mile varies from a maximum in the District of Columbia of 1,459 to a minimum in Nevada of 3 people to the mile.

About $80,000,000 in labor and materials were expended in 1904 on improving the roads. When the amounts expended on pavements in cities and towns are added to this, we have a

large total invested in streets and roads in the United States each year.

Statistics are hard to obtain, and the office of public roads will do us a great service if this work is continued and extended. This inquiry might with profit be extended to the cities in regard to data concerning improved pavements. It is very hard now to obtain paving data from cities in any reliable shape for comparison.

With reference to progress in street cleaning, the rate seems to be slow. Several authorities have stated recently that hand sweeping of block pavements, such as granite and the like, is still superior to any machine sweeping. All machines apparently require a smooth pavement in good surface and repair to be of any advantage. Numerous places have tried flushing machines on smooth pavements with success. New York and Brooklyn attest the fact that flushing the pavements occasionally is of great advantage to aid the cleaners in providing for flushing from hydrants in connection with the new high pressure fire protection systems.

A number of our large cities are devoting more attention to the cleaning of pavements than formerly,—notably Chicago and Boston. Boston has been examining into her cleaning system very recently with an idea toward its improvement.

In general many of our cities spend a great deal of money on cleaning the streets without proper supervision of the work. The evidence of experts would point out that we should spend money lavishly on the direction and supervision and do the saving on the lower grades of labor.

STREET CLEANING IN DETROIT.

By Frank Aldrich, Superintendent of Streets, Detroit, Mich.

Theories are usually so much more interesting than facts, that I am afraid that what I have to say about street cleaning will not be especially interesting to many of you, particularly those who have had practical experience and must have arrived at the same conclusions that I have. The greater part of what I shall bring to your attention is the result of personal observation and practical tests.

But first of all, I wish to call your attention to the vast importance of clean streets and alleys, not only in large cities, but where a number of people are living in close proximity. One of our magazines published an article last year entitled, "Dirt and Dust," and I wish it might be reprinted by every newspaper in the land in the first column and kept there for a whole month, until every person who could read would become familiar with the facts therein expressed. I wish to quote a part of this article. The writer says:

> One of the most important causes of modern physical deterioration is the lack of open air life, the common lot of all city dwellers. The greatest surgical discovery of the nineteenth century was dirt,—matter in the wrong place. The greatest medical discovery that will be made in this century will be "dust." It takes at least two hours in fresh air every day to counteract the effects of the dust we inhale, without estimating the wear and tear of the tissues due to nature's excretory effort to intercept the terrible enemy. If we would evade this death-dealing dust, the cause alike of consumption, sore throat, cold in the head and pneumonia, it is essential to betake ourselves to parks and open air spaces, green fields and country lanes. Many diseases of the alimentary canal are directly brought about by the contamination of food which has been exposed in a dust-polluted atmosphere, and in these days of motor cars far more elaborate precautions ought to be taken. For centuries dust has been the bane of the thrifty housewife, as she has regarded it as a form of filth; it soiled linen, silks and other household fabrics as well as

the hands and persons of those who came in contact with it. Since delicate machinery has come into such general use, dust has acquired another enemy, as those who have charge of such machinery realize that it injures and destroys it. If dust, by its mere presence, so readily harms industrial machinery, may it not affect the *human* machine in much the same manner? Of this there can be no question; but as regards the human machine, dust is also a disseminator of disease by carrying and depositing specific micro-organisms within the body where they may multiply and induce various disease processes. Major Firth, of the English army, has stated that the typhoid bacillus may remain alive and fully virulent for twenty-five day in dirt which has been dried and blown about as dust.

Yes, the medical profession have become aroused to the fact that dust blown about in the air we breathe is dangerous, and articles are frequently appearing in the medical journals on this same subject. Therefore, is it not important that every one having any responsibility under our city governments should feel it a duty to exert his influence to the fullest extent to remove this danger to public health. Any amount of money judiciously expended to keep the dust out of the air we breathe is well spent. Unfortunately Detroit, and I suppose every city, has a large number of tax payers who think that appropriations for city work should be no larger next year than they were last year. Such people can never see that anything has been accomplished with the money expended and are constantly demanding that more work should be done, and no matter what success is attained no credit for your efforts may be expected from this class of people. Every city has another class of people dangerous to the public health, and those are the people who own property on unpaved streets and alleys and refuse to sanction paving, for no other reason than that it would cost them a few dollars. Many of them no doubt are ignorant of the danger to the health of their families, and that they may incur doctor's bills that would amount to more than a paving bill. If we could, in the City of Detroit, have every dirt street and alley paved within a radius of two miles of the city hall, we would never have another complaint of dust, and I believe the sick list would be lessened 50 per cent

for all throat, lung, nose and eye troubles. I have drawn these conclusions from information received from conversations with some of the best of the medical profession of our city. And in proof of this, I wish to call your attention to the fact that for the past two years we have been flushing one and one-quarter million square yards of our brick and asphalt pavement, and on September 11th, just past, our health officer, Dr. Guy L. Kiefer, says in a published extract from his annual report, "The health of the city was very good last year. In some respects it has been remarkably good. The report will show that in the diseases which are reported to the department there has been a very marked decline. This class includes smallpox, diptheria and scarlet fever, and shows a much smaller percentage of typhoid fever." If any man had the power and the nerve to bond our city, even to the bonding limit if necessary, and pave all of our dirt streets and alleys in the built up section, in less than two years he would be considered the longest headed man in the whole community and the best friend the tax payers ever had. Why? Because the dust nuisance would be abated, the health of the city would show a still greater improvement and it would cost less money to clean our streets. But it is difficult to convince some people of the utility of any new process in any line. It has been no easy matter to overcome the prejudices of many of our people against the flushing methods of cleaning streets, and some still contend that our pavements are being ruined by this method. They think that water sent onto the pavement under high pressure is loosening and tearing out the cement between the brick, and some even assert that it is very fast wearing off the brick and asphalt. If it were possible for water even under high pressure to injure the cement in the few seconds which the water is flowing on it from a flushing wagon, then how could cement be used for bridge piers, where the water is continually flowing against them? I have watched closely the results from flushing all kinds of pavements, and I have found that it is not safe to flush cedar block pavement, because too often, through

the carelessness of the tar pourers, they do not get the tar much below the surface of the street, therefor the pressure of the water in such places lifts the tar from the gravel between the blocks and thus injures the pavement. But on brick or asphalt, I have found that it is not only the best plan for cleaning, but it is most beneficial to the pavement. Whether tar or cement is used between the brick, all of it near the surface of the pavement will crack and loosen from the brick as soon as heavily loaded wagons pass over it. This is caused by the shallowness of the cement over the rounded edges of the brick. The more the edges of the brick are rounded the deeper the cement will break away, and any irregular prominence on the brick will chip off and all of this loose material will be pressed into any space below the level of the surface of the pavement. Even brooms will not remove this, but the flushers clean out all the loose matter and thus expose all the imperfections in the pavement which already existed but were covered. Naturally any one who arrived at their conclusions from the appearance of the street just before its first flushing, and then viewing it just after, might be justified in concluding that the cement had been injured, but if they will watch it week after week they will discover that the crevices are getting no deeper. Now, as to the benefit derived by these pavements on account of flushing. Sooner or later, in all kinds of paved streets, pockets will form where sand and dirt will gather. After a rain water will stand in these holes and every wheel that goes over that wet sand grinds the hole a little deeper, until in a few weeks or months there will be a pronounced chuck hole there, and, if it be neglected, it will soon be down to the concrete. These depressions in the pavement are usually caused by permit gangs, who tear up a small section of the street and then fail to put the dirt back as compactly as it should be, therefore the pavement settles. But the flusher comes along and washes all of that sand out of the depressions as well as off the smooth pavement, and the friction between the wheel and the pavement is removed.

Gentlemen, this question is so important, in my judgment, to the welfare of every community, that I hope you will pardon me for criticising an article which appeared a few months ago in an engineering journal, over the signature of the writer. It was entitled, "Injury by High Pressure Flushing." The writer said that "the injury and destruction of the pavements are not only done by erosion on the surface, but by means of the water penetrating through joints and small openings and thus getting under the pavement as a whole or under the blocks of streets paved with brick or stone blocks." And then he goes on to prove his theory with figures showing the lifting power of water at 60 pounds pressure under a pavement. I think it a crime against humanity to publish such an article, for, coming from the source it did, it doubtless would be the means of preventing some town officials from selecting the flushing system, which is proving so beneficial wherever used. Suppose there were holes in the pavement, how much water could percolate through those holes in the few seconds the flusher is playing on any one spot, and how much pressure would there be to that water when it reached the bottom of the brick? Just the weight of the water and no more.

We flush our down town streets twice a week, and the outlying streets once a week. The teams work on the flushers twelve hours; the inspectors eight hours. We run our flushers in pairs, the inspector handling the hose at the hydrants and supervising the work. During the past summer we have been flushing about 1,300,000 square yards and sweeping 4,275,000 square yards of pavement. Our flushing has been done with four machines, working them night and day. The city has just purchased four more machines, and we shall hereafter flush all of our brick and asphalt pavements, amounting to about 3,000,000 square yards. During the summer we use about 100 "white wings" to pick up the droppings.

I am often asked, "How much does flushing add to the expense of cleaning the sewers?" The basins have to be cleaned a little oftener, because, in the immediate vicinity of the sewer

opening, the heavy rush of the water will carry into the basins all the sand and dirt, but only the sand remains in the basin and the light dirt goes into the sewer, the same as it would with the water from a heavy rain storm. When the flushing wagon gets a few yards from the sewer grate, the sand will settle on the pavement at the curb, to be removed by the dirt wagons. I am satisfied, from the investigations that I have made, that the small increase in the expense of cleaning sewer basins is more than offset by the benefit the sewers derive from the large volume of water which passes through them from the flushers. It cleans the sewers and carrys along the waste which often remains too long stagnant in their bottom.

Again referring to the action of the water on the pavement, I want to state that I have lately made a test, by placing brick inside of a wooden frame and slushing the crevices with the usual proportions of cement and sand. After standing two weeks I placed the brick under a stream of water which has about 30 pounds pressure and allowed the water to run onto the brick and cement for over 48 hours. This represents more washing than a pavement would receive from flushing in three years, and the wear is hardly noticeable.

Gentlemen, I should not blame you if you had come to the conclusion that I had stock in some flushing machine company. That is not true, however. I am simply very deeply interested in the subject of street cleaning, and notwithstanding the great improvements in the methods, I believe the science of street cleaning is practically in its infancy. That is, when our view point is from the side of efficiency and expense. For about six months in the year the flushing and sweeping machines can keep the streets comparatively clean, but the flushers depend on the use of water and the sweepers must have a sprinkler precede them to keep down the dust. So the frost stops all of this kind of street cleaning. Of course, the dust is not as harmful in the winter as in the summer, yet it is most unpleasant to those whose business calls them onto the street,

and the rank and file of the people do not stop to consider that the Department of Public Works is practically helpless in the winter as far as the removal of dust is concerned. They insist that the Department must keep the streets just as clean as in the summer, and, notwithstanding that these demands are unreasonable with present facilities, we sympathize fully with the public and are just as anxious to adopt improvements in this line as the people are to have clean streets. We believe that a compressed air machine, that will draw up the dirt from the streets, without raising a cloud of dust, is what must come into use, and with such a machine I believe the dust problem would be solved for the whole year.

DISCUSSION.

THE PRESIDENT: This paper is now open for discussion.

MR. FOLWELL, of New York, N. Y.: The apology of the gentleman for giving not a theoretical but a practical paper is one which is entirely uncalled for, as I think the most desirable papers we can receive in this convention are papers with just such practical facts, deduced from actual experience, as he has given us. The fact is that what we need here, what all engineers need, is more practical results and less theory. Any engineering journal can get hold of and publish very readily plans which some one has drawn up for a plant of some kind, or a statement of methods which are about to be carried out, but it is very difficult to find anywhere published, or in any papers read, actual statements as to results; and those, it seems to me, are something which we should lose no opportunity to obtain where we can and present when we have the figures, and I think the Society owes a debt of thanks to the reader of this paper. The matter of flushing streets and flushing them in this way is one practically new to the cities of this country. Of course it has been done for several years and yet comparatively few cities have tried it systematically and I know the results in Detroit will be read with considerable interest and listened to with considerable interest by others. It seems to me the question of the stopping up of sewers with the dirt washed in from the streets, which has been an argument used by many and which has honestly bothered many city officials and made them question the advisability of using these machines, is perhaps based upon the somewhat wrong assumption that the washing

or flushing of the street is to be carried on in the same way as it used to be done, by means of a fire hose attached to a hydrant. Many of you undoubtedly have seen streets washed that way, where worn out hose of the fire company was borrowed by the street department or turned over to the street department and attached to a hydrant, and, beginning at the top of the grade, the water was carried across and gradually worked down to the bottom of the grade. and all the dirt was carried ahead of the water until it came to the next catch basin and all washed in there. In regard to what seems to be one fault found with machines of this kind; the machine does not wash the dirt all down hill but sideways into the gutter, and as the reader of this paper has said, and as I have observed to be the case, it is only the dirt in the immediate vicinity of the catch basin that goes in; most of the dirt stays in the gutter. The lighter dirt. the small and light particles of dust and other matters in the street which will float possibly will be carried into the catch basin, but that same material will also be carried through the sewer. As an indication of the fact that most of the sand is left in the gutter and not carried into the catch basin, I might cite the report of the Superintendent of Streets of a neighboring city, Mr. Neave, of Cincinnati. In his annual report he suggested that the street cleaning department be furnished with wagons with tight bottoms, the particular reason being that the other wagons allowed drippings of the street dirt to be scattered along the streets. The facts in this case were that these flushing machines were used, and employees came along afterward and gathered up the dirt into carts and carried that to the dump, and that dirt was of course in a very wet condition as it wouldn't do to let it lie two or three days on the street to dry out, because the teams would scatter it, but it had to be picked up in a wet condition. It would drop out from the tail boards of the carts all along the street. This throws a side light on this method of cleaning, showing that a large amount of the dirt was left in the gutter to be collected by the carts and was not washed down into the sewer. I hope this paper will bring out discussion, because I am very much interested in this matter. I have no decided opinion one way or the other, but am anxious to learn the experience of others in this matter.

Mr. C. H. Rust, of Toronto, Canada: I am very much interested in the paper just read by Mr. Aldrich. The condition of the streets in Detroit speak very highly for the system now in use. I cannot, however, agree with the writer as to the fact that water does not have any injurious effect on the pavements. In Toronto we have been flushing the streets, practically upon the same system, and I am satisfied that we are injuring our pavements. For many years we adopted the dry system and the pavements were certainly never in better condition as far as their wearing

qualities were concerned, but of course the dust caused a very much greater nuisance than it does now. In the case of asphalt pavements which may look very even, after a year or two there are always a great many depressions and the water lodges in these depressions and there is no doubt that the pavements are injured.

The question of the best method of cleaning our streets was before the Council some time ago and they decided that owing to the numerous complaints made by the storekeepers that we should adopt the flushing system, and the property owners seem to be satisfied that even if the pavements are injured, they would be quite satisfied to have the pavements renewed more frequently than to be smothered with dust.

MR. L. H. WEISSLEDER, of Cincinnati, O.: This particular flushing machine that has been mentioned and similar flushing machines have been adopted quite extensively, and also a machine that was brought out in Europe. They call it the Squegee Flushing Machine. This machine has a roller in the rear with rubber on it, and that sweeps or brushes or wipes the dirt into the gutters by trips back and forward covering the asphalt and brick streets, and it has been said—perhaps I say this without authority—but it has been alleged that the sewers become clogged with the filth from the streets that has been washed into them and where there is not much fall from the sewers, the dirt putrifies in the sewers, where the periods of rainfall are far apart, and there is some protest against that method of doing the work. But that is a matter that can perhaps be thrashed out by further experience along that line and this objection may be removed. But there is no question but that the flushing of streets with the ordinary flushers and this squegee machine is the best method of keeping the streets clean. After one of those machines has passed over an asphalt street, you can walk across there in your slippers without any discomfort.

MR. C. C. BROWN, of Indianapolis, Ind.: There has been one point brought out which it seems to me is of some importance, and that is with reference to the effect of water on the pavement. That depends, according to my observations, upon two things, one, the force with which the water is applied to the pavement, and the other is the direction from which it is applied. We have used in Indianapolis both the hose and the air pressure system of applying the water, with high pressure and with rather low pressure, and I think now we have gotten down to a rather low pressure with a method of applying the stream or flow of water which brings it out very nearly horizontally. In that way perhaps the wagon has to go over the streets a little oftener or the hose has to go over it oftener, but it has a less serious effect upon the pavement. The amount

of dirt washed down does not seem to be so serious, because there has been no particular complaint from the sewer department of a large increase in amount of work in cleaning the catch basins. I want to say with reference to the cleaning of brick streets which the paper spoke of, that the question of the washing out of the filling between the bricks is very largely one of good filling. I had the opportunity a short time ago of examining some streets which have been very thoroughly filled with the best of cement filling, and they have been down now for ten years, and I found in those streets that the cement stuck to the bricks and filled the joints and made a smooth pavement, a pavement which did not give the ordinary rough shaking which we get from riding over a brick street. That was true not only where the joints were perfectly straight, the brick edges smooth, but where there happened to be breaks in the brick in handling which had to be filled by the cement. I think that a street of that sort would not be injured by this method of cleaning. It is not at all difficult to get this sort of filling. It is simply a matter of following a first class specification, as, for instance, the one which the National Brick Manufacturers' Association recommend. I saw a number of streets in two cities upon which I believe we would have no difficulty such as this.

With reference to the matter which the paper mentioned of the effect of the pressure of the water in lifting the brick, I had an opportunity to discuss that in an article which I presented for publication, and I made somewhat the same point that the paper does, that the pressure which would be applied to the surface of the brick would amount to very little by the time it reached the bottom. The amount of space that there is in the cracks for the water to get down below is so slight that the water would lose all its pressure and there would be no such effect as the gentleman describes.

MR. E. A. FISHER, of Rochester, N. Y.: In regard to flushing streets. In Rochester the Commissioner of Public Works flushes about twenty asphalt streets by using ordinary sprinkling wagons. They hold about 750 gallons each. In the wider streets we run two of them close together, and open the valve the full width. The water strikes the pavement in about the same manner as a heavy shower. In our city we have no catch basins, and it would be very bad for the sewers to have heavy material washed into them. The streets are therefore thoroughly cleaned by hand labor first and the flushing is done immediately afterward. There is no attempt to clean the streets by flushing, but the water takes off the fine dust. The work has been very satisfactory to the people generally. A number of streets have been flushed during the early evening, and many complaints have resulted from this practice because it incommoded pedestrians. This detail will probably be remedied next year. I believe

this practice is one which will go into general use with us in the near future. My recollection is that we use about a gallon and a half of water per square yard. It runs all the way from one to three gallons.

THE PRESIDENT: For each application?

MR. FISHER: Yes, for each application. The streets in the central portion of the city are flushed three times a week, and others twice a week. We prefer three times a week to keep them free from dust. No appreciable detritus is washed into the sewers. Any fine material that is carried by the flow in the gutters will readily remain suspended and be carried off by the flow in the sewers. As I said before, we have no catch basins.

HORACE ANDREWS: Mr. Aldrich's paper emphasizes the fact that in street cleaning, hygienic precautions outweigh mere outward appearance of neatness. The cleaning of the carriageways has been discussed very thoroughly, but the sidewalk cleaning has not been touched upon at all; yet the area of the sidewalks is in general four-tenths, or over that of the entire area of a public street. As a matter of fact, we rely on the owners of adjoining property to clean their sidewalks, otherwise they are not cleaned at all in most of our cities; yet the thorough cleaning of sidewalks is of great hygienic importance. I have noticed on the streets here a number of signs requesting persons not to spit on the walk; presumably the carriageways are to be used for that purpose. It is generally conceded by medical authorities that tuberculosis can be conveyed by the sputum of those afflicted with the disease. In the State of New York alone the average number of deaths from consumption is 14,000 each year, or 38 *daily,* and this average has been maintained with great regularity for several years past. In view of this fact the thorough flushing and cleaning of all sidewalks may be regarded as of the highest importance and should arouse the attention of our municipal authorities. The dust from the sidewalks is readily blown on to articles of food exposed out of doors. As far as my observation goes, there is no city where the exposure of articles of food to the dust of the streets is prohibited. The practice of thus exposing articles of food is an alarmingly dangerous one, and it is within the power of our city governments to prevent it entirely. Let us preserve the entire area of our streets in a neat and orderly condition, but at the same time we should not overlook simple precautions without which the purest of foods may be converted into conveyors of a disease more deadly than all our wars or accidents by land and sea.

MR. ALDRICH: Mr. Folwell, in his discussion of the street cleaning problem, referred to the report of the Superintendent of Streets of another city, who thought that "the flushing system would require the use of tight

wagon boxes to remove the slush." I am in favor of having every wagon box tight that is used for transporting any kind of street or alley dirt; but as we have to handle the dirt after the flushers, we do not use any better boxes than for other work, because, within a short time after the flushing, our laborers pile the dirt into small heaps, a few inches from the curb, so that the water drains within a few hours and the dirt can be removed without any dripping of water to the street.

I listened with much interest to the remarks of Mr. Rust, and with all due respect for his opinions I must still stick to my view that flushing improves the wearing powers of a pavement. Depressions in asphalt or brick pavements will gather and retain more or less sand and grit; if it rains, or the street is sprinkled, the water will stand in the low places with the sand, and every wheel passing through it grinds the hole a little deeper. But when the flushing machine goes over the street it digs out and carries to the gutter the dirt and sand and although water may remain in the depressions, the water alone will not increase the wear of the pavement.

Mr. Brown referred to the force with which the water is applied to the pavement. I agree with him that it is important. When I tried some of the machines as we received them from the manufacturer, I found that the nozzles as attached were too high from the pavement and I lowered them so that the water could be thrown nearly horizontally. On asphalt this increased the yardage per hour considerably and the cleaning of the street was satisfactory. But for flushing brick pavements, we always set the nozzles at a pitch which will dig the dirt from the holes and crevices between the brick. This, of course, requires more water and the work is slower. The pressure of the water at the hydrants in Detroit varies from 18 to 42 pounds, according to the locality. We do not find the higher pressure too much for good work. Much less work is accomplished per hour in the low-pressure localities.

I fully agree with Mr. Andrews' suggestion about washing the sidewalks. I am sure it would aid greatly in disposing of the disease germs which locate in dust and dirt. In hot weather sidewalks on the main thoroughfares should be flushed early every morning.

GUARANTEE CLAUSE IN PAVING SPECIFICATIONS

OF THE CITY OF CHICAGO.

By John B. Hittell, Chief Engineer of Streets.

Prior to 1898, the City of Chicago, in order to guarantee the fulfillment of the maintenance clause in its street paving contracts, in addition to a personal surety of fifty (50%) per cent of the amount of the contract, retained, upon the completion of the work, five (5c) cents per lineal foot of curbing, which was to be paid back in two equal annual installments, and twenty (20c) cents per square yard on asphalt, brick and granite block pavements, a one-fifth (1/5) part of which was to be paid back yearly, or until the expiration of the guarantee period of five (5) years. On cedar block and macadam there was retained six (6c) cents per square yard, which was returned in two (2) equal yearly payments, the guarantee period being two (2) years.

In the latter part of that year the specifications were revised, requiring Portland cement in the construction of the concrete foundations for asphalt, brick and granite block pavements, and the guarantee period extended to ten (10) years; and as a guarantee a surety bond was accepted in the sum of fifty (50%) per cent of the amount of the contract, and the cash retainer was no longer required. With but one exception, all the contractors who had previously done work under a 5-year guarantee were bidders on the work under the new conditions. The guarantee clause, as then inserted, was as follows: The italicized words are mine and made so as to more clearly indicate the subsequent change by omission:

It is hereby understood and agreed that the material furnished and used and the workmanship employed in the construction of the said pavement shall be of such character and quality as to insure the same to be free from all defects, and in continuous good order and condition and

satisfactory to the Board of Local Improvements, ***ordinary wear excepted,*** for a period of ten (10) years from and after the completion and acceptance of the same; and as a guarantee of the faithful performance of these specifications, the quality of the material furnished and the proper construction of said improvement, the contractor or contractors hereby agree to keep and maintain the said improvement, without additional charge or cost to the City of Chicago, in such good order and condition as will be satisfactory to the Board of Local Improvements, ***ordinary wear excepted,*** for a period of ten (10) years from and after the completion and acceptance of the same, which keeping and maintaining shall include repairs or the entire reconstruction of the same, ***the necessity for which may be occasioned by or through the use of faulty or inferior material or workmanship, or from any other cause whatsoever;*** provided, however, ***the contractor or contractors shall not be required to keep or maintain any part of said improvement under this guarantee which, after its completion and acceptance, shall have been removed for the purpose of laying or repairing any gas, sewer, water or other pipe, in accordance with the permit granted by the City of Chicago for such purpose, except as hereinafter provided.***

Should the said pavement be cut or removed for the purpose of laying or repairing any gas, sewer, water or other pipe by parties having first obtained a permit from the City of Chicago therefor, the contractor or contractors agree to, within five (5) days after notice so to do from the Board of Local Improvements, relay, repair and repave said pavement in strict accordance with these specifications and with such material and in such manner as will leave the whole pavement in as good and durable condition as it was before the same was cut or removed, the cost thereof to be paid for at the rate of $........ per square yard by the City of Chicago out of its general fund.

If the contractor or contractors shall fail, neglect or refuse to repair, keep and maintain the said pavement in good order and condition, in accordance with these specifications, within five (5) days after notice so to do from the Board of Local Improvements, the said Board of Local Improvements may proceed to do so or cause to have done the work necessary to comply with the same, and collect the cost and expenses thereof from the said contractor or contractors or his or their bondsmen.

Up to January 1st, 1907, there were approximately two hundred and fifty-seven (257) miles of asphalt, seventy-six (76) miles of brick, twenty-two (22) miles of granite and one and one-half (1½) miles of creosoted block laid under this 10-year guarantee clause. In the past nine (9) years there have been

many changes in the personnel of the contractors, due to deaths, failures, combinations or other causes. A very great percentage of this work, of course, has been done by contractors who are still doing business for the City of Chicago, and who have therefore maintained their work without recourse to unusual proceedings; but with six (6) different contractors, involving over thirty (30) different streets, it has become necessary to make repairs where the contractor and surety company have both failed so to do in response to an order from the Board of Local Improvements.

In a legal opinion rendered for the Board of Local Improvements, it was held that it could bring suit, under the contract, upon an estimate of the cost of the repairs, although the city had been to no expense in making any repairs. Accordingly, when a street needed attention, it was customary to serve a notice upon the contractor, giving him five (5) days in which to make repairs, and if, upon the expiration of that time, nothing had been done, to notify the surety company; and if they likewise refused or failed to comply, an estimate of the cost of such needed repairs was furnished the legal department and legal proceedings instituted for the recovery of such amount. Undoubtedly, as a proper method to pursue under the contract, this was correct; but as these cases were filed in the Circuit Court, not being emergency cases, they had to take their turn on the calendar, and have not yet been called, although instituted in February, 1904.

In the meantime the condition of the pavements was getting worse and worse, department officials were being harassed by the numerous complaints, and the city was being held liable for accidents resulting from the dangerous condition of the streets. In but two (2) instances did the surety companies respond and make repairs, and in one instance they held negotiable papers of the contractor's sufficient to reimburse them for any expense incurred; in the other instance it was the only contract upon which the company was the surety and they desired to keep in good standing with the City of Chicago, the Board of Local

Improvements having notified the heads of other departments of the failures of these companies to comply with the request of the Board of Local Improvements.

When called in consultation, they have in general held their refusal for making repairs as being based upon such technicalities in the specifications as that the material and workmanship had been inspected by the City of Chicago, and had been passed upon by its officials; or that the actual expenditure had not been made by the city; or that the condition of the street was due to extraordinary wear, which was excepted specifically in the contract and specifications.

As an example of the operation, I have in mind one street which was paved in 1901. The pavement began to disintegrate two years after construction, so that the contractor had to make repairs in 1903. In the spring of 1904, the contractor having gone out of the paving business, the surety company made the repairs; in the fall of the same year the street again needed repairs, and the contractor and surety company refusing to do anything further, the city was obliged to appropriate money and make the repairs. The street was again repaired in the fall of 1904 and in 1905, and in 1906 it became evident that repairing in places was of no avail, and it was then decided, after detailed notes of the street were made and photographs taken, to advertise for the entire resurfacing of one part of the street which had always been the worst, and to repair the remaining part and take a guarantee for this work to extend to the date of the expiration of the original 10-year guarantee, viz., 1911. When the surety company was called in, it stated, in substance, that it could do nothing until the city had secured a judgment against it and its principal, because the principal had warned it to pay only at its peril, stating that he did the work under city ordinance and specifications, complying in all cases with the instructions of the inspectors and engineers, and that the city accepted the work and thereby relieved him from further obligation.

Arising from this case a form of guarantee was used which differed from the guarantee of 1898 only by the elimination of

those words which have been italicized, the attorney holding that "the legal effect of the new guarantee would be to limit the number of justifiable reasons that a surety might assign for refusing to respond to his obligation; and the principal distinction between the old form of guarantee and the new would be that the wording of the old form would admit of many more possible grounds for evasion by the surety than the new one."

Not allowing that this sufficiently strengthened the position of the city, the fact remained nevertheless that any document involving any contract can be taken into the courts for judication, and I believed it advisable to take up with the Board of Local Improvements, in 1906, the question of again returning to a cash reserve and a shorter guarantee period.

In my communication to the Board I was of the opinion that it was desirable to return to the method of the cash reserve, based upon a set figure per square yard of pavement, or on a percentage in dollars of the total amount of the final contract quantities, with a further security by personal or other bonds. If such a change was to be made, it was advisable to limit the period of guarantee on asphalt, brick, creosoted block and granite block pavements to five (5) years instead of ten (10) years, and possibly on granite block to only three (3) years.

To illustrate the application of such a reserve, take the cost of the work done during 1905 by one of the asphalt paving companies, viz., $1,400,000.00. The retained moneys, at ten (10%) per cent would be $140,000.00; and the total amount so retained, assuming that the cost of the work for a number of years would be constant, would, on a 5-year guarantee period, be three times this amount, or $420,000.00. Correspondingly, the probable total maximum amount of all retained moneys would be $1,200,000.00. If provision could be made to pay five (5%) per cent per annum, say $60,000.00, on the retained moneys, the reserve voucher would be readily negotiable, and hence the use of this system would, in my opinion, not increase the cost of the work. Among the objections which might be brought against this scheme are:

1. The question as to the legality of the city council appropriating money for such purposes.

2. Likelihood that the retained moneys would considerably reduce the capital of contractors of limited means and deter such from bidding upon the work.

3. Similarly, it might be a hardship on contractors customarily doing a large amount of work, who most likely work on a smaller percentage of profit, and who would soon have a large amount of capital tied up, as illustrated in the extreme case cited.

4. That it could be stated that were this amount retained, it itself would not be sufficient to pay for reconstructing the entire wearing surface in the case of asphalt, brick or creosoted block pavements.

The points that might be mentioned as favorable to this plan are:

1. That the cost of the great number of repairs needed on the pavement is but small in comparison with the amount retained, and the board would be duly protected in the matter of having repairs made.

2. That with the moneys in the possession of the board, the ordinary repairs would be made, because contractors would endeavor to secure the return of the reserve.

3. With the moneys in the hands of the board, the board could spend the money and then defend the suits, while at present it has to spend the money and prosecute the suits.

4. That if not sufficient moneys were secured on a street to entirely pay for the reconstruction of the surface, the board very likely would be in a position, with the accumulated reserves of the ordinary contractor, to act most arbitrarily in the matter.

5. That under the present system we have had twenty-eight (28) lawsuits and have had repairs made on but three (3) streets, and none under such conditions that they could be considered as precedents made by the guarantee companies.

From this arose our present form of guarantee, by which we retain on asphalt, brick, creosoted block and granite block, five (5%) per cent of the total amount of the contract, including all items such as curbing, grading, paving, etc., and which is as follows:

It is hereby understood and agreed that the material furnished and used and the workmanship employed in the construction of the said improvement shall be of such character and quality as to insure the same to be free from all defects, and in continuous good order and condition satisfactory to the Board of Local Improvements, for a period ending five (5) years from and after the first day of December next following the completion and acceptance of the same; and as a guarantee of the faithful performance of these specifications, the quality of the materials furnished and the proper construction of said improvement, the contractor hereby agrees to keep and maintain said improvement, without additional charge or cost to the City of Chicago, in such order and condition as will be satisfactory to the Board of Local Improvements, for the period ending five (5) years from and after the first day of December next following the completion and acceptance of the same, which keeping and maintaining shall include repairs or the entire reconstruction of the same; provided, however, that if the said pavement should be cut or removed for the purpose of laying or repairing any gas, sewer, water or other pipe by parties having obtained a permit from the City of Chicago therefor, the contractor agrees to, within five (5) days after notice so to do from the Board of Local Improvements, relay, repair and repave said pavement in strict accordance with these specifications, and with such material and in such manner as will leave the whole pavement in as good and durable condition as it was before the same was cut or removed, the cost thereof to be paid for by the City of Chicago out of its general fund at the rate of three ($3.00) dollars for each square yard and fraction thereof; provided, however, that the compensation for the repair of any single opening shall not be less than ten ($10.00) dollars.

It is hereby further understood and agreed that in order to enforce the faithful performance of the terms and conditions of said above agreement on the part of the contractor to keep, maintain and repair said improvement, the City of Chicago, through the Board of Local Improvements, may, upon the completion of said work, retain five (5%) per cent of the cost of the total work performed by the contractor on the following terms and conditions:

If the contractor shall fail, neglect or refuse to repair, keep and maintain said improvement in good order and condition in accordance

with this contract and specifications within ten (10) days after notice so to do from the Board of Local Improvements, the City of Chicago, through the said Board of Local Improvements, may, without further notice to said contractor or surety, immediately have such repairs made and pay for the cost thereof out of said five (5%) per cent reserve fund, first, either in cash out of the money so retained or by voucher issued in favor of the party employed to make such repairs, drawn against the original assessment warrant; or, second, in case the five (5%) per cent herein retained is insufficient to pay the cost of repairs, then the same may be paid for in the same manner out of any moneys retained or which may hereafter be retained in the manner as aforesaid on other contracts made or which may hereafter be made by the within contractor with the City of Chicago for street improvements constructed under special assessment proceedings.

And it is expressly agreed that any moneys paid or vouchers issued in payment for repairs in accordance with this agreement shall be considered as so much money paid to the contractor herein, and said contractor hereby releases and discharges the City of Chicago and the special assessment warrant from all claim or obligations to the extent of the money so paid for repairs, the same as though such money had been paid to the contractor.

At the end of each year from and after the first day of December next following the completion and acceptance of said work, if the said improvement, and any and all other improvements under contract by the contractor in the City of Chicago, shall be in such good order and condition as will be satisfactory to the Board of Local Improvements, the City of Chicago shall pay the contractor one-fifth (1/5) of the money which shall have been so retained by the City of Chicago on the contract herein as aforesaid, together with the ratable interest thereon collected by the city upon the installment of the assessment out of which such installment of reserve fund is payable, less any amount which the City of Chicago may have expended for repairs as aforesaid; and at the end of each succeeding year the City of Chicago upon the same conditions and with like deductions shall pay the said proportionate amount, to-wit, one-fifth (1/5) part (and ratable interest as aforesaid) from all the money so retained until the amount shall be paid.

No interest shall be paid upon the money so retained where the assessment for the improvement is collectable in one installment.

It is hereby expressly understood and agreed that if a contractor fails, refuses or neglects to make the repairs on the improvement herein provided for, after notice as aforesaid, the City of Chicago may not only use the moneys retained as aforesaid on said improvement, but may apply

any moneys which may have been retained as aforesaid on contracts for other improvements, to make the repairs on the improvement herein provided for; provided, however, that the moneys retained as aforesaid on the improvements herein provided for shall be first exhausted before the moneys retained upon any other improvement shall be so used, but, except in cases of public urgency, the City of Chicago stipulates that it will not require repairs to be made between the fifteenth day of November and the first day of the next succeeding April.

It is further understood and agreed that the money to be retained as aforesaid shall be deemed only as security additional to the bond of the contractor executed to secure the performance by the contractor of this agreement, and that the liabilities of the contractor shall in no way be abridged or modified by the retention of said money as aforesaid.

As will be seen, the period of guarantee for all streets expires at one and the same time, and, while there is not retained a sum sufficient for extensive repairs upon any individual street, I believe that the sum of reserves for any appreciable amount of work done by a contractor will be sufficient to thoroughly protect the city.

Upon the completion of the work the contractor is issued the following certificate which can be hypothecated at the banks:

CITY OF CHICAGO.

RETAINER'S CERTIFICATE.

THIS IS TO CERTIFY, That............................Dollars has been retained by the CITY OF CHICAGO out of the total amount for work done by.....................on.....................contract for the improvement of.. under Special Assessment Warrant No..........

Now if the said.....................or.....................surety shall well and truly perform the requirements set forth in the contract for said improvement as to the guaranty and maintenance of the same upon this and other improvements, the CITY OF CHICAGO will, on the first day of December each year, commencing one year after the first day of December next following the completion and acceptance of the work, upon the surrender of the attached coupons in their consecutive order and of this certificate at the end of the fifth year, issue to..................... or.....................assigns special assessment improvement vouchers, payable out of said special assessment fund, but out of no other fund whatever, a voucher or vouchers for one-fifth (1/5) of the amount so

retained by said city. Said vouchers to draw interest at the rate of five (5%) per cent per annum, payable annually, from ...., 19...,
as is evidenced by this certificate and the five attached coupons.

BOARD OF LOCAL IMPROVEMENTS,
By.............................President.
..............................Secretary.

No form of guarantee and reserve will be ample to protect the city against inferior workmanship, and the remedy, it appears to me, will have to come by the granting of broader powers to those in whom is intrusted the awarding of contracts, and that the word "responsible," as commonly used in the expression "the lowest, regular, responsible bidder," must be taken in the moral as well as financial sense.

DISCUSSION.

MR. HOWARD: For twenty-six years I have been disgusted with seeing streets paved with "guarantees and bonds," so that within a few years cities have "guarantees and bonds" in the treasury and no pavements on the streets. City halls, sewers and water works are constructed under engineering supervision. It is our duty as city engineers and municipal engineers to see that the work is done correctly in paving, just as it is the duty of the architect to see that the city hall is built correctly, and I am heartily in favor of reducing the guaranty periods to such short times that contractors can have the privilege of correcting any errors they make. I believe in holding the city engineers responsible for the proper construction of pavements, the same as they are held responsible for water works and sewers. I have been in several court cases where it was decided that if a city has accepted a pavement and paid for it, it is almost impossible, if the pavement is bad, to recover anything on the bonds thereafter. Therefore, although I have the highest respect for the gentleman who wrote that paper, we do not want the pavements of our cities to keep on getting into the law departments. I heartily endorse the idea, there stated, to reduce guarantees to shorter periods. This period of guarantee should never end in winter under the snow, but as is now the case in Paris, London, Philadelphia and many other cities, it should end on the first day of June. This brings it at a time when the new work for the year begins and at a time when it is possible for the city to inspect those old pavements and also enable the contractor to make

proper repairs in good weather. So I criticise that paper because it has too much in it about continuing guarantees, and also for permitting guarantees to terminate in winter.

MR. OWEN: My views coincide with those of Mr. Howard on this question of guarantee. As a matter of fact, the existence of a guarantee is an evidence of an engineer's incompetence. I can see no reason except as a matter of expediency for the guarantee being extended and amplified as it is at the present time. My own experience in that guarantee business, although not strictly confined to street pavements, in road constructions was on the same line. Some thirty years ago when I began road construction, I put in, as was customary, a one-year guarantee; that is, that the contractor should leave the pavement at the end of one year from acceptance in the same good condition as it was when accepted. I found that the practice then was that in the last month of the guarantee a sufficient coating would be put on to patch up any trouble that existed, but it finally worked out that after the guarantee had expired the repair department came into play. So I practically eliminated the guarantee clause at once and for many years have constructed roads without a guarantee. I depended on the selection of good material and the good faith of the contractor, and on not accepting the work until I was satisfied it was done according to contract. That is my individual experience along that line.

As to the question of the bond, I don't know how it is in many cities, but originally the bond for faithful performance of contract extended indefinitely; that is to say, there was no practical release to the bond which was filed, and it became an archive in the department there and was in existence all the time. The practice now is, especially with surety companies, that after acceptance of the work by the authorities they insist on a release of the bond, so that practically the bond is merely a guarantee for the faithful performance of that work. We have had numerous cases where the contractor has failed, and even the bondsmen have failed, and the city has no recourse. I do not say you can get along without a bond, but I think the people should be educated in accordance with Mr. Howard's idea of getting first, proper construction, and then very careful inspection before there is an acceptance of the work.

MR. RUST: In Toronto we have for a number of years provided in the specifications that all our permanent pavements, such as asphalt, brick and granite setts, should be guaranteed for a period of ten years, and we retain for that purpose 15 per cent of the amount of the contract, the city allowing the contractor interest at the rate of 4 per cent. We do not retain any drawback upon macadam, except for the period of one year. It has

been questioned by some parties whether the city have the right to ask contractors to maintain pavements for the period of ten years, the cost of which is charged against the abutting property owners, and it probably would be more satisfactory, providing you get proper inspection, to pay the contractor in full when the work is completed. The payment of the interest on these drawbacks half yearly involves a large amount of book-keeping. On concrete sidewalks we retain 15 per cent for a period of five years.

MR. DENMAN: Can the last speaker give an adequate idea of what in excess of the 4 per cent the contractor charges for this retention of that portion of the contract price; in other words, does he add the expense of these various guarantees as nearly as he can?

MR. RUST: No doubt they do allow in their contract for this contingency, and I have no doubt that we could get the work done cheaper without this guarantee and retention of the percentage. I would say, however, that our contractors thus far have not failed to carry out the work. We have had no trouble in getting repairs made. Of course we are dealing with only a few very reliable contractors.

MR. WILL P. BLAIR: I would like to state from a study of something over thirty years of municipal problems that it has always seemed to me that a guarantee bond for any work is a substitute for supervision, and that the services of an engineer for proper supervision is far cheaper and far better than the cost of the maintenance and guarantee bond to the taxpayer.

MR. BOCK: I have never seen a pavement kept good by a bond, and every time you burden a contractor with a bond or a retainer you simply increase the cost of the work to the taxpayer and the city. If in the construction of street pavements or any other kind of public work, the engineers will provide for the best kind and class of material, and the best possible construction, and give it good intelligent supervision, then you get construction you cannot get if you load it down with tons and tons of bonds. Take that provision we have heard about in Chicago. What is the result? The taxpayer has to pay for all of that. You don't suppose the contractor will invest his money and leave it there for an indefinite period of years. That is not the kind of an investment he makes, and it seems to me, and I believe practical experience will teach you all that, as I have remarked, select your material carefully and exercise supervision over the work, and you have the construction you want at the smallest possible cost.

MR. DENMAN: I desire to call attention to a form of guarantee that has prevailed in our city that comes under the name of "optional guar-

antee"; that is, a guarantee for five years absolute, and before or at the expiration of that period for a further guarantee. The municipality retains the right to require it for an agreed extension of that time, five years, perhaps, so that it makes the guarantee full ten years at a price per square yard. I merely wish to call the attention of the convention to that form of guarantee and perhaps draw out an expression of opinion on that feature of guarantee which I did not observe was touched upon in the paper submitted, as that paper seemed to contemplate an absolute term or period only. We have been putting that in force in our city, and while it is true it has not been enforced long enough yet to try out its real merits, yet at the same time it seemed to be theoretically a method proper for reaching and presenting a solution of the problem.

MR. DOW: I believe Mr. Hittell has been unduly criticised here. I have found that the guarantees work different ways. Several instances have come to my notice, one in South Bend, Ind., where the pavement went all to pieces and the company refused to look after it. The concrete is worthless under it, and the city authorities believe, and I think justly, that the paving company should replace the entire pavement. Another case, the City of Washington requested the contractor to repair a pavement at the end of the guarantee and they refused to do it, saying that the city had allowed railroad tracks to be laid in the street, temporary railroad tracks, and while the representative of the paving company, when the paving was examined after removing the tracks, admitted that no damage had been done to the pavement, yet they held that as one cause for relieving them from the guarantee. Numerous instances come up all over the country where contractors put up similar technical points as a reason for relieving them from maintaining their pavements.

GUARANTEES FROM A CONTRACTOR'S STANDPOINT.

By W. N. Andrews, of the Andrews Paving Co., Hamilton, Ohio.

I have given this subject some little thought, enough to satisfy myself that I may be only repeating what has already been said upon the subject of guarantees; but I believe that a contractor does not object to the so-called long time guarantees, if he gets enough money for his work. Surety companies are exacting in the way of collateral, demanding as much as 25 per cent of the original cost price on ten-year maintenance bonds, which very materially adds to the cost of the work. City authorities could save this extra cost if they would employ competent experts to lay out their streets and supervise their construction, as they do when they build a sewerage or water works system. No contractor, if he is honest with himself, objects to an intelligent inspection of his work. However, he does object to having placed over his work an incompetent person, who in many instances is the owner of property on the street to be paved, who does not know the first thing about his duties, and tries to make a reputation for himself at a contractor's expense.

A year ago this summer, at the writer's suggestion, the City of Green Bay, Wis., after contracting for about two miles of asphalt paving, employed a consulting engineer to recommend a suitable mixture, embodying the use of a good asphalt, for the surface material, and furnish a competent person to supervise the work and see that instructions were carried out. The result was, we were pleased to be relieved of the responsibility connected with obtaining the proper mixture, and the city authorities felt that they were getting what they paid for and were satisfied. This work, after passing through a rather severe winter, in that there were many radical changes of temperature (which is hard on asphalt pavements), is in per-

fect condition, the best evidence of which is that the city is converted to the use of asphalt as a paving material, and have let a large amount of new work this year and expect to let more next year. This inspection cost the city less than two cents per square yard, and personally I believe the pavement will last many years and never cost us a cent for maintenance. This city has not only learned the value of expert knowledge, but it has learned how to care for an asphalt pavement, which will go a long way toward preserving its life.

Guarantees on street pavements no doubt grew from the over-zealous desire of manufacturers of new forms of permanent pavements to back up their representation of durability and usefulness with agreements to keep them in repair for a period of years. This is as absurd when applied to street pavements as it would be were the durability of the materials in a building or its construction guaranteed for a period of 10 years.

Courts have repeatedly held that it is only the proper use of a street as a roadway that is guaranteed, and if it can be shown that other causes contributed to the destruction of the street under guarantee, no recovery on the part of a city can be had. If there is any question about the enforcement of guarantees for paving, and there always is, why place upon the legal department of a city any additional burden which should have been assumed in the first place by the engineering department?

I do not believe there is a contractor in the country who does not favor closer inspection and doing away with guarantees, and I cannot help but believe that cities would profit by it very materially in the end.

REPORT OF THE COMMITTEE ON ELECTRIC STREET LIGHTING.

By Edwin A. Fisher, C. E., Chairman, Mem. Am. Soc. C. E., City Engineer, Rochester, N. Y.

Your Committee on Electric Street Lighting would respectfully report as follows:

The general tendency has been to lower prices in cities lighted by private plants. Considerable attention has been paid to the ornamental effects of street lighting. The lamp now in most general use is the enclosed arc operating on either the direct or alternating current. Among the later types of lamp is the flaming arc. This has been more extensively used in Europe than in America. Its widest use in this country is in situations where its brilliancy may attract attention, as for advertising purposes.

Another kind of lamp is the metallic arc lamp. These lamps, operating with a less amount of electric energy, have been used in cases to replace enclosed arc street lamps, with an improvement in the street illumination. They are manufactured by both the General Electric and the Westinghouse companies.

Incandescent lamps have been used in some cities, more especially at Los Angeles, for ornamental effects. The Tungsten incandescent lamp, operating on an alternating current giving about 50 candle power, is being used for lighting alleys, and in places where the full power of an arc lamp is not required.

Public feeling with reference to municipal ownership of public utilities has recently radically changed in favor of the regulation of public service corporations, including street railways, street lighting, and other similar utilities. New York state has recently created two bodies known as the Public

Service Commission, one body known as Part 1, having control of the steam and electric railroads and gas and electric companies in the City of New York; and the other body, known as Part 2, having control of the same utilities in the remainder of the state. These commissions were organized on July 1st, 1907. The legislature conferred extraordinary powers upon both these bodies. As both commissions were made up of competent and reliable men, it is expected that they will regulate and control the corporations in such a manner as to result to the best interests of the community.

Mr. William H. Floyd, Jr., C. E., of St. Joseph, Mo., a member of the Committee on Electric Street Lighting, in a letter to the chairman of the committee, states that owing to a rush of work he will be unable to attend the convention this year, but submits a brief description of the St. Joseph municipal plant made up by Mr. W. C. Stewart, the city electrician. This description reads as follows:

ST. JOSEPH, MO., September 24th, 1907.

W. H. Floyd,

St. Joseph, Mo.

Dear Sir:—

Complying with your request for a brief description of the St. Joseph municipal lighting plant, will say that no commercial lighting is done. Our equipment is for street lighting only and is as follows: A building 130x60 feet contains 200 H. P. Bonson boilers, one 500 H. P. Twin City Corliss engine, together with the necessary heaters, pumps, etc. The electrical equipment consists of six 145-lamp Brush multi-circuit, direct-current, constant-current dynamos, marble switchboard equipped with the necessary accessories.

The system of lighting is the General Electric Company's "magnitite system." The lamp is a 300-watt lamp and in light value is termed nominal 2,000-candle power, although from luminometer tests we find this lamp has from 15 to 20 per cent more illuminating power than the old open arc 10-ampere 50-

volt lamp, rated at 2,000 c. p. We have 560 of these lamps lighting about 145 miles of streets. As to cost of operation, I give you cost per lamp for the past fiscal year, as follows:

Operation and maintenance per lamp	$37 74
Interest per lamp	5 75
Depreciation per lamp	8 63
Lost taxes per lamp	1 25
Total	$53 37

Courteously yours,

W. C. STEWART,

City Electrician."

Mr. Floyd says that the cost of operation is for an every night and all night service, and is about 30 per cent less than it was under the old system on a moonlight schedule. The power house is of brick on a concrete foundation, and the building, including furniture and fixtures, cost $19,674.60, and the equipment $56,675.65. The building was erected and equipped in the year 1905.

ORNAMENTAL STREET LIGHTING.

By Edwin A. Fisher, City Engineer, Rochester, N. Y.

Much attention has recently been given to the ornamental, as well as the efficient, lighting of main thoroughfares in the larger cities. The following brief descriptions of several such systems may be of interest:

Los Angeles, Cal.

At my request the city electrician, Mr. R. H. Manahan, gives the following information relative to the method of lighting four of the principal streets of that city:

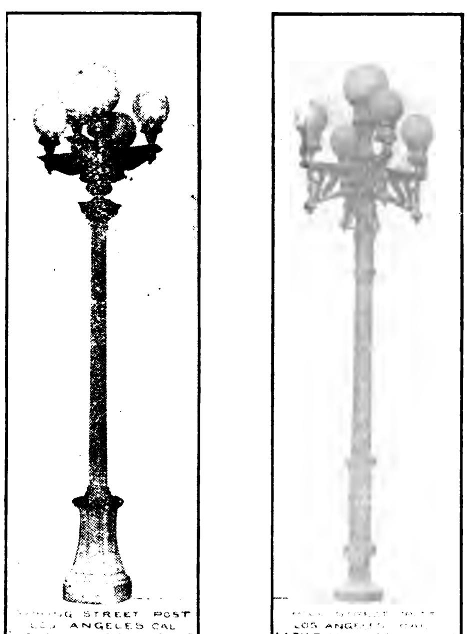
"The first lighting by incandescent lamps on ornamental posts on our business streets was taken up by the merchants and property owners on Broadway, working under their organization known as the Broadway Improvement Association. This association, by means of subscriptions from property owners and merchants along the street, raised funds for installing 135 cast iron ornamental posts. These posts are located at about 120 foot intervals along each side of the street and originally contained an aggregate of 384 candle power in twelve 32-candle power incandescent lamps. This would be equivalent to nearly thirty-seven 450 watt arc lamps per block, there being 12 posts per block on this particular street.

"The cost of lighting these posts was assumed by the city, and as one can readily see from the above comparison, was a very expensive method when considered apart from its advertising and artistic features, and in view of other streets asking for the same improvement, the experiment was tried of reducing the aggregate candle power one-half, with very satisfactory results both financially and from the standpoint of illumination, the general effect looking down the street being practically the same.

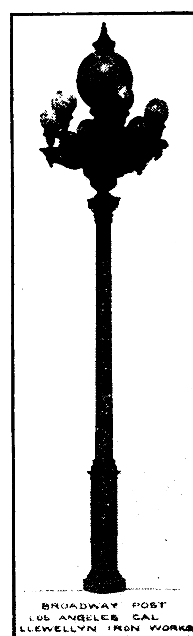
"Owing to the difficulty the Broadway Association had in securing subscriptions from all the property owners on the street, an act was passed at the next session of the state legislature enabling property owners along any street to institute proceedings for improvements of this character. Upon favorable action by the city council an assessment district was formed upon which the cost of the improvement was levied in the same manner as is done in ordinary street improvement work.

"The three other principal streets upon which the ornamental posts are now installed used the assessment method and it has been very satisfactory in operation.

"We have, as you will see by the photos, two general types of posts, the four-arm and the six-arm, with 16-inch or 18-inch top globe.



FOUR-ARM POSTS.



SIX-ARM POST.

ELECTRIC LIGHT POSTS, DENVER, COL.

"The six-arm post is the one adopted by the Broadway Association and the present arrangement of lamps consists of three 32-candle power lamps in the 18-inch top globe and one 16-candle power lamp in each of the 8-inch enclosing frosted globes.

"The four-arm post used on the other streets contains three 8-candle power lamps in each 12-inch globe on the arms and three 32-candle power lamps in the 16-inch top globe.

"Provision has been made on the later posts, erected for extra circuit wires, which may be used for decorative lights, strung along or across the streets. The connections to these posts were installed by the respective lighting companies at their own cost; having underground conduits already in the street, they simply ran the necessary service wires from their manholes to the posts at a nominal expense.

"Lighting hours for these posts vary according to conditions. On the main business streets all posts are lighted until midnight, and after midnight two posts at each street intersection. In the semi-residence section all posts are lighted until 10 o'clock and balance until 12 o'clock or later, as desired by the property owners.

"In the following tabulated form I have shown the extent and original cost of installing the posts, including globes and necessary wires to the base of the post, at which point the lighting companies connect their service wires; also the total cost, and cost per front foot for current for one year.

"In conclusion, it is my belief that in view of the rapid improvement being made in the incandescent lamps, both as regards efficiency and candle power, that the lighting of streets both in business and residence sections can be done quite economically considering the artistic effect that can be obtained with ornamental posts and incandescent lamps.

"In connection with the lighting of these posts by the various companies I neglected to state that the entire maintenance of the posts is made a part of their contract, this including all necessary repairs to wiring, broken globes and renewals of

lamps and necessary cleaning and washing of the enclosing frosted globes. All lamps are renewed at the expiration of 800 hours' burning, so that the post shall be as uniformly lighted as possible; lamps burning out or becoming defective during the 800 hours period being, of course, renewed immediately.

"The cost of lighting these four streets has recently been taken up by the city with the respective property owners and the city agreed to assume one-half such expense, the balance being collected by the method outlined in the legislative act to which I referred. We have before us petitions for four other streets for similar improvements, but in these cases the entire cost for installation and current will be paid by the property owners."

TABLE SHOWING DETAILS AND COST OF INSTALLATION OF ORNAMENTAL LAMP POSTS IN THE MAIN STREETS OF LOS ANGELES, AND COST OF LIGHTING THE SAME.

Furnished by R. H. Manahan, City Electrician.

ORNAMENTAL POSTS.

Street	Length in feet	Number of posts	Candle power per post	Total candle power	Cost of installation	Cost per front foot	Cost per post
Hill.........	8445	164	192	31500	$17,294.00	$ .94	$105.25
Broadway....	7125	135	192	25900	14,000.00	1.00	103.00
Spring........	5750	132	192	25300	14,628.00	1.06	110.00
Main.........	9420	163	192	31300	19,000.00	1.10	116.00

COST OF LIGHTING OF ORNAMENTAL POSTS.

Street	Rate per K. W. hour	Yearly cost	Cost per front foot
Hill..	3¾ cents	$9,200.00	$0.50
Broadway...............	3¾ cents	7,780.00	.556
Spring	3¾ cents	7,625.00	.65
Main....................	3¾ cents	9,810.00	.568

DENVER, COL.

Mr. Henry Read, Chairman of the Art Commission of the City and County of Denver, in a letter dated September 21,

ELECTRIC LIGHT POSTS, ROCHESTER, N. Y.

1907, gives a description of the ornamental lighting of Sixteenth street, one of the main business streets of Denver.

He says the posts were designed to furnish a support for the span wire of the electric railway system and also to provide for carrying the feed wires on top, as well as to provide for the ornamental lamps. The outer casing of cast iron was made larger on account of having to stand the strain of the span wire than would otherwise have been necessary. The poles were set at a distance of about 90 feet on each side of the street. There are four pairs of standards to the block, set in the curb, those on the street intersections being placed two feet outside the lot line of the transverse streets. Blocks 266 feet, including 16-foot alleys. Street 80 feet wide, including the sidewalk. The lamps are alternating current enclosed arcs of 110 volts, 6.6 amperes, in opal globes; the outer one only being used so as to present a single line vista down the street. Eleven blocks were so lighted at a uniform cost of $60 per lamp, under a provision of the franchise granted the Denver Gas and Electric Company. The expense is borne by the city at large. The total cost of equipping this street was about $16,000. The merchants of other downtown streets are insisting that the new municipal lighting be extended to other principal streets of the city.

Cleveland, Ohio.

Mr. William J. Carter, Chief Engineer of the Board of Public Service, states that the lighting of the downtown streets is taken care of by the abutting property owners or business firms, the city allowing the section of the street upon which they maintain their lights the expense of operating enough lights to provide the necessary street lighting. This lighting costs the abutting property owners about $3.00 per front foot per year. The lamps used are arc lamps, 220 volt, hung in pairs and spaced about 100 feet apart.

Rochester, N. Y.

Rochester has had its principal main streets lighted for several years with arc lamps hung in pairs on iron poles used

generally with the railway company as trolley poles. These lamps on Main street are spaced about 100 feet apart on each side of the street, and present a very brilliant appearance. This lighting is paid for entirely by the city at large. Buffalo, Syracuse and some other cities light the main streets in a similar manner. The main street in Rochester has a more brilliant illumination than any of the others that I have observed.

Pasadena, Cal.

Mr. Manahan, of Los Angeles, states that in Pasadena they have approximately twenty blocks on three of their business streets lighted with 16 candle power incandescent lamps, arranged on posts as shown in the cut. He was unable to give any information as to the cost of the posts or of the lighting. He says they are very much less expensive than the type in Los Angeles, and he considers them better adapted to park or residence lighting than for business streets, "as they do not possess the dignity, to our prejudiced minds, required by streets of staid and financial aspect."

Detroit, Mich.

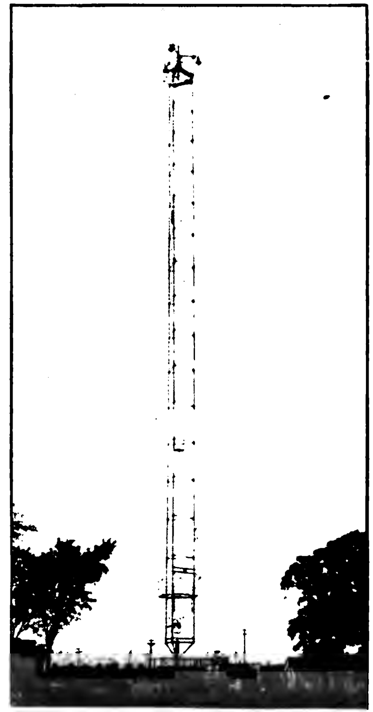
The Public Lighting Commission, in its report for the year ending June 30th, 1907, says the tower system used by the city in connection with the street lighting is a unique feature. These lights may be seen many miles away by the traveler approaching. There are now 135 towers in use, classified as follows:

1—165 feet in height,
2—160 feet in height,
107—150 feet in height,
18—125 feet in height,
7—100 feet in height.

Of these towers, one in the central portion of the city has 6 arc lights, 64 have 4 arc lights each, and 70 have 3 arc lights each. There are also 30 ornamental poles with double arc lights and 310 ornamental poles with single lights.

ORNAMENTAL POST, PASADENA, CAL.

DOUBLE-LIGHT POST.



LIGHT TOWER.

SINGLE-LIGHT POST.

ELECTRIC LIGHT POSTS, DETROIT, MICH.

PUBLIC LIGHTING PLANT OF DETROIT, MICH.

By William M. Daly, General Superintendent.

In complying with the request of the chairman of your Committee on Electric Street Lighting to prepare a paper on the above topic, it is my aim to deal only with facts and present these in as concise and clear a manner as my ability will allow and your time permit.

The events which led to the establishment of the public lighting plant of this city were the usual ones. The fact that private corporations furnishing a public service generally tended rather to corrupt the public officials dealing with them than to better the service, caused the growth of the sentiment and ultimately the demand for a municipally owned and operated plant, and Mayor Pingree was the man to bring this about.

In his message of January 12th, 1892, he submitted reports from 88 cities in the United States showing that Detroit paid a price greatly in excess of the average. Again in his message of January 10th, 1893, he submitted reports from 92 cities owning and operating their plants, showing the cost to be considerably less than the lowest contract price in any city lighting by contract. In view of this and the ever-increasing complaints of lamps out, he had a bill prepared, introduced and finally adopted in the legislature of this state.

This act, signed by the governor March 18th, 1893, conferred the power upon the City of Detroit to issue bonds to the extent of $800,000 for the purpose of buying or building a municipal lighting plant. It also created a commission, to be appointed by the mayor and approved by the council, for that purpose and to operate the same. The referendum vote on the question, submitted April 3d, 1893, resulted in its adoption by the people, 15,822 yeas to 1,245 nays.

April 23d, 1893, the common council adopted a resolution to establish such a plant and on May 9th authorized the issue of bonds to the amount of $600,000, approved by the Board of Estimate May 19th. May 24th, 1893, the commission having been appointed and confirmed, the common council directed them to take the necessary steps for the establishment of the plant and on December 22d the bonds were sold at a premium of $27,540.

The three year contract with the Detroit Electric Light and Power Company expiring June 30th, 1893, and the council having rejected their proposition on March 14th, the public lighting commission arranged with that company to have them continue lighting the city from month to month at the following rates.

827 lamps at former contract price.
440 lamps at 35 cents per lamp per night.
12 lamps at 48 cents per lamp per night.

The Detroit Electric Light and Power Company's proposition, rejected by the council, above referred to, was as follows:

One year contract per lamp	$155 73
Two year contract per lamp	148 43
Three year contract per lamp	124 10
Five year contract per lamp	120 45
Seven year contract per lamp	109 50
Ten year contract per lamp	102 20

When the public lighting commission began lighting the city in April, 1895, a uniform rate of $11.15 per lamp per month was agreed upon as a basis for all lights still to be furnished by contract until the municipal plant was in full operation, October 1st, 1895.

As the scope of this paper is too limited to go into the details of the construction work, I would respectfully refer those interested to the annual reports of the commission, but as bearing on the mooted question of depreciation, I would here state that the site selected for the plant has a frontage of 218 feet on Atwater street, and 161 feet on the channel line of the river; that the average depth of the lot is 365 feet and its area

64,175 square feet; and that it cost $63,125. The buildings erected thereon cost $72,247.78. The several lines of conduits and tunnels comprising 181,794 duct feet, cost, inclusive of manholes, $43,382.58; this is at the rate of 23¾ cents per lineal foot for 3-inch vitrified clay ducts laid in concrete; also 33,258 feet of 2½-inch iron pipe at 34¾ cents per foot cost $11,570.81. A grand total of $190,326.17.

Here, then, we have nearly one-third of the original investment that, as a whole, has not only not depreciated but is considerably more valuable today. For the purpose of making a proper comparison I tabulate the services and their cost for the first decade. The records of the city comptroller's office show that the entire amount appropriated by the council and board of estimates and paid out by the city on account of the lighting plant was as follows:

	Operation.	Investment.	
Original investment			$655,508 90
1895	$125,603 27	$32,675 00	
1896	124,255 00	25,745 00	
1897	121,000 00	83,780 00	
1898	56,000 00	23,000 00	
1899	95,000 00	41,945 00	
1900	96,000 00	....	
1901	98,000 00	55,328 00	
1902	103,975 00	82,200 00	
1903	117,917 00	55,763 50	
1904	122,246 13	56,510 00	
			456,946 50
	$1,059,996 40		
Total amount invested			$1,112,455 40
Total paid for operation and maintenance			1,059,996 40
Grand total paid by the city for lighting and plant			$2,172,451 80

Services rendered:

Year	K. W. current for arc.	Number of arc lamps.
1896	2,407,232	1,481
1897	2,716,628	1,600
1898	2,973,135	1,820
1899	3,182,293	1,919
1900	3,327,453	2,002
1901	3,475,389	2,042
1902	3,672,255	2,302
1903	4,284,576	2,454
1904	4,399,291	2,597
1905	4,780,397	3,005
	35,218,649	21,222

April 3d, 1893, the common council adopted a resolution to establish such a plant and on May 9th authorized the issue of bonds to the amount of $600,000, approved by the Board of Estimate May 19th. May 24th, 1893, the commission having been appointed and confirmed, the common council directed them to take the necessary steps for the establishment of the plant and on December [illegible] the bonds were sold at a premium of [illegible].

The three year contract with the Detroit Electric Light and Power Company expiring June 30th, 1893, and the council having received [illegible] on March 14th, the public lighting [illegible] with that company to have them [illegible] month at the following [illegible]

[illegible]

64,175 square feet; and that it cost $63,125. The buildings erected thereon cost $72,247.78. The several lines of conduits and tunnels comprising 181,794 duct feet, cost, inclusive of manholes, $43,382.58; this is at the rate of 23¾ cents per lineal foot for 3-inch vitrified clay ducts laid in concrete; also 33,258 feet of 2½-inch iron pipe at 34¾ cents per foot cost $11,570.81. A grand total of $190,326.17.

Here, then, we have nearly one-third of the original investment that, as a whole, has not only not depreciated but is considerably more valuable today. For the purpose of making a proper comparison I [illegible] the first decade. The [illegible] show that the entire amount [illegible] board of estimates and paid [illegible] lighting plant was as follows

Original investment .... [illegible]

1895	[illegible]	[illegible]
1896	[illegible]	[illegible]
1897	[illegible]	[illegible]
1898	[illegible]	[illegible]
1899	[illegible]	[illegible]
1900	[illegible]	[illegible]
1901	[illegible]	[illegible]
1902	[illegible]	[illegible]
1903	[illegible]	[illegible]
1904	[illegible]	[illegible]

Total amount [illegible]
Total paid in [illegible]

Grand [illegible]

Service [illegible]

[illegible]

Year.	K. W. current for incand.	Bldgs. supplied.	Number of lamps.	Motors.
1896..........	220,653	14	2,503	
1897..........	263,784	19	3,006	
1898..........	299,630	30	3,901	
1899..........	357,274	34	4,911	
1900..........	461,597	40	6,679	
1901..........	497,961	42	6,948	
1902..........	651,594	62	11,780	
1903..........	984,820	108	14,183	32
1904..........	1,000,814	122	14,871	35
1905..........	1,104,144	132	14,696	39
	5,842,271			

Stating the illuminating power of the incandescent lamps and motors in terms of arc lights, the total number of arc lights for the decade was 24,788 (an average of 2,479 arc lights per year); thus, as President Hetherington in the tenth annual report of the commission says, "if all the property of the public lighting commission, including land, buildings, etc., were obliterated, wiped out of existence, the total cost to the City of Detroit would have been $87.63 per arc lamp per year. The lowest contract bid for the same time was $102.20."

But the opponents of municipal ownership claim this showing is not fair to them, since within this time so many improvements in machinery, etc., have been made reducing the cost of service, and private corporations would have rendered the same or better service for less money. Happily we are in a position to meet this assertion. Comparisons may be odious, but the one that Mr. Hetherington makes in the report above referred to is so eminently illustrative on this point that I deem it proper to draw your attention thereto.

The City of Buffalo is a well-lit city, though no more so than Detroit. It is in the same class as Detroit in every respect except that its location is more favorable to securing cheaper electric current from Niagara Falls. This advantage ought to enable Buffalo to excel all other cities as far as lowness of cost of lighting is concerned.

At the time Detroit's plant went into operation, Buffalo entered into a ten years' contract starting with a rate of $117.75 per arc light of 2,000 candle power per year. This was

reduced in 1897 to $100.00, and again in 1902 to $75.00, making the average cost per arc light for the ten years $91.77, or $4.14 more per arc light per year than Detroit has paid in the same time. Now, while this in itself ought to be considered a favorable showing for Detroit's municipal plant, I wish to emphasize this fact, that while Buffalo has at the end of the decade nothing to show for its expenditure except a lot of receipted bills, Detroit has not only those but a fairly up-to-date plant worth at least a million dollars.

The number of lamps operated, the output of the plant in K. W. hours of current and the total amount paid by the city for the installation, operation and maintenance of its plant stand out so prominently that all juggling with percentage of depreciation, etc., cannot possibly befog them.

Lately the plant, its system of accounts, its records and the commission's reports based thereon have been subjected to exhaustive investigation by experts of international renown. Although I have not received a copy of the official report of the investigating committee of the Civic Federation, I understand, from what the newspapers report, the committee does not seem to have found anything wrong of sufficient importance to mention it.

And now I deem it necessary to touch the tender spot. The point which more than any other is criticised and attacked by private corporations and their editorial staff, the point which their experts glory in to befog with technical terms—the actual cost price per arc light, of a given candle power, and per K. W. hour to the consumer, who in this case is the city.

In establishing this cost price the commission has to deal with existing conditions of the plant, the cost of coal, etc., and the cost of labor. The system adopted by the commission to ascertain the actual cost of an arc lamp of 2,000 C. P. per year and that of the unit of K. W. hour current for incandescent lighting is as follows:

All the expenditures of the year which are necessary for operation and all those which are necessary for maintenance

of the established plant are charged to the product, the maintenance is sub-divided into the arc and the incandescent. If an old machine or contrivance is replaced by a new one, the difference between the price of the new and that of the old one less the depreciation of three per cent per year and the actual amount received in its sale is charged to maintenance, and this actually to the product, be it incandescent current or arc light. Thus President Stanton in the twelfth annual report states the amount expended in operation and maintenance of the

		K. W. hours.
Arc light system to be	$112,201 87	5,601,648
Incandescent light system to be	31,659 20	1,580,577
	$143,861 07	7,182,225

The average number of arc lamps operated during the year was	3,374
Arc cost, $112,201.87, divided by the average number of arc lights, 3,374, makes the cash cost	$33 25
Arc lamps, machinery, and tower discarded	6,281 05
Three per cent depreciation on entire plant, $1,054,527.45	31,635 82
Four per cent interest on net investment July 1, 1906, at $902,641.25	36,105 65
Lost taxes at an estimated assessed value of $594,900 at rate of $18.23 per M	10,845 03
	$84,867 55
Cash cost of operation	143,861 07
Gross cost of operation	$228,728 62

This divided proportionately between the arc and incandescent output gives the following:

Arc cost	$178,392 80
Incandescent cost	50,335 82
Thus the operating disbursements per arc lamp are	33 25
Depreciation on account of discarded machinery, etc	1 45
Depreciation on investment at 3 per cent	7 31
Interest on investment at 4 per cent	8 35
Lost taxes	2 51
Gross cost per arc lamp	$52 87
Cash cost per kilowatt hour	$0.02003
Its proportionate share of depreciation, etc	.01182
Gross cost per K. W. hour	$0.03185

There is no secrecy connected with the ascertaining of the costs. No arrogant display of a "higher scientific knowledge" is necessary to determine them. The commission is dealing

only with plain and simple facts, open to the examination of any one. It is not involved in the dark intricacies of a sliding scale system with special discriminations; it has only one rate, that of the true costs, and were it empowered to do commercial lighting this democratic system would apply to all alike.

I have so far confined my remarks mainly to the economic value or price of current produced and distributed by our plant. But conducted as it is and for the purpose of rendering, at cost, services that otherwise, in the hands of private corporations, would be made to pay handsome dividends, (not mentioning water), its very existence is a menace to all depredatory public lighting contractors and all those supplying commercial light and power under any other than a flat scale. It is, therefore, easily seen that Detroit's municipal plant has been on the firing line since its purposes were recognized, for it leads to comparisons and it is these comparisons that are feared by those that seek an unfair profit. In this way Detroit's plant has been a service to all other cities.

In closing I desire to convey my sincere thanks to you for the honor conferred on me in affording me this opportunity of vindicating a much maligned undertaking of the people of this city.

NEW KINDS OF STREET LAMPS.

By L. H. Weissleder.

Mr. Chairman and Gentlemen of the Convention: As to the term "Paper," that I might possess on this subject, I think that perhaps may create a false impression. I have just gathered a few notes and they are somewhat in the nature of information as to the newer methods that have recently obtained from experiments made at the Columbia University of New York City.

The latest lamp tested was the Helium, an incandescent of good light from 1000 to 1200 hours, and the efficiency was about 1 watt per candle. The engineers here who understand that term will realize the great advance made in the science of electric lighting when we say that 1 watt will produce a candle power. That will probably result in an entire change of lighting the streets in many places, especially where a new contract is about to be awarded for street lighting, and that is by erecting posts with the lamp at an altitude of not to exceed 14 feet, with clusters of incandescent lamps spaced anywhere from 75 to 100 feet apart. That will give the ideal illumination and will permit street intersections to have a lamp at each corner, the alleys to be provided with the same character of light, and in that manner distribution of light can be had that will exceed in economy anything so far in use. One of the economical methods of street lighting obtains in Cincinnati. The system was installed in 1892 and 1893 and it took some time to do it. We use alternating series, but of low wattage. Unfortunately low wattage was selected. It is a 4-ampere lamp. If that lamp or the system were provided to produce 6½ amperes with the same number of lamps, I have no hesitation in saying that Cincinnati would be the best lighted city in the world. There are now upwards of 6000 lamps in the City of Cincinnati. We

have no towers. In the small district down town we have two lamps at street intersections and two in the center of blocks. In the balance of the city, in the basin of the city, we call it, the streets have but one lamp at the intersections and one in the middle of the block, and those are usually placed at the alleys whenever practicable. In that manner we get very efficient lighting.

Other lamps that have recently been exploited are the Tungsten lamp and the Tantalum lamp. The Tungsten lamp has a light of about 1000 hours with an efficiency of 1 watt per candle. The Helium lamp has also a similar efficiency. The Tantalum has a shorter life, about 800 hours, with an efficiency of 1½ watt per candle. The Helium lamp is believed to be the very best. Its filament is of fibrous character; those of the others are metallic. The Tungsten and Tantalum lamps are not fitted for lighting places where there is much jar, for instance in trolley cars or places of that kind; but the Helium lamp is believed to meet all the requirements that a good carbon lamp possesses.

One of the late lamps of the arc type is the Flaming Arc. That is a lamp that we have seen in many places used only for advertising purposes, to attract attention. It is in a class by itself and by no manner of means is it a lamp suitable for lighting interiors of stores and places of that character.

The chairman of this committee has referred to magnetite or luminous arc lamps. That is an efficient lamp. One street in Cincinnati was lighted as a test last year, and it was proven to be a most acceptible illuminant. The lamps have a candle power of three and four thousand, estimated. The beam of light thrown out from this lamp forms a horizontal beam, which is much better than the old French method possessed by the old Brush & Thompson house arcs, where the beam of light was thrown at an angle of 45 degrees from the vertical. The magnetite uses a direct current and makes a very efficient lamp, but rectifiers are required on alternating currents. Fifty or seventy-five lamps can be placed on a circuit, and the lamps

need to be trimmed but once in 175 hours. The electrodes are of copper. They cost 25 cents and will last six months, and the carbon costs 5 cents and with a 175-hour light we have there a very long period of burning without retrimming, which is one of the duties that devolves upon an electric lighting company; that is the trimming, the keeping of its lamp up, and we have been unable to eliminate that duty. The incandescent lamps, of course, will furnish the ideal method of lighting because there is no retrimming and they burn with high efficiency. Grouped as they are on Michigan avenue in Chicago—there were two blocks lighted by these lamps, and they were in clusters of five close together—the illumination was reported to me on last Monday as being very satisfactory. I will not take up the time of the convention further and I thank you for your attention.

DISCUSSION.

THE PRESIDENT: I am interested in the Magnetite lamps and should like to hear more about them.

MR. C. C. BROWN: In regard to the Magnetite lamp, I have some figures which will be of interest. I visited the City of Paris, Ill., a short time since, a city of perhaps 5,000 population, and they have had an electric light plant since back in the eighties. It is a municipal plant; they have no commercial lighting whatever. Their first plant was equipped with the open arc lamps. After a while they put in the enclosed arc system and reduced the horse power necessary and increased the number of lights. That gave, of course, a considerably higher efficiency. Two years ago they put in the magnetite lamp and reduced the horse power again, so that their engine is now fully equal to the 140 odd lamps which they are using. The following communication from the city engineer will give the figures necessary for exact comparison:

As per your request, I will attempt to give you a brief history of our municipal electric light plant. The first installation was made, after serious opposition by the local gas company, which had a contract to light our streets with gas lamps, during the year 1885, by installing four Fort Wayne (Jenney) 25-ampere generators and placing seventy-five 2,000 c. p. open arc lamps on our streets, operated by one 125 h. p. Ideal engine.

This system was changed to the enclosed arc and operated by No. 12 General Electric Brush 6.6 amp. generator with capacity of 120 2000 c. p. lights, purchased and installed during the year 1899. During the year 1906, this system, while giving satisfaction, was found to be too small for the requirements of the rapid growth of the city, and after recommendation of the superintendent as to duplicating present engine and generator or the installing of the then new system known as the luminous arc or magnetite system and using the same engine, the latter was adopted, and the purchase was made covering one No. 13 Brush arc (General Electric with capacity of 200 2000 c. p. lights) and 150 magnetite lamps costing $6,625.00.

A brief reference to the annual reports of the three systems may be of some interest to you. While there was but little information obtainable in reference to the first installation, from the annual bills I have concluded that the cost of operating the 75 lamps was something above $80.00 per lamp and from indicator card taken from engine just previous to the change to enclosed arc I get the following: 78 lamps, 25 amp., i. h. p., 115.

The enclosed arc cost to operate $56.00 per lamp and from same engine as above 116 lamps, 6.6 amp., were operated with i. h. p., 101.

While the magnetite system has been in operation only four months, from the monthly reports I deduce that this lamp, while being 25 per cent more efficient or giving 25 per cent more light, will only cost $47.00 per lamp per year, and there are operated from the same engine 132 lamps, 4 amp., with i. h. p., 78.6.

From the foregoing we must conclude that the engine has improved most wonderfully by age or that this new lighting system is a perfect success. I now have 146 lamps in service and contemplate increasing this to 155 lamps with same engine. These lamps have given perfect satisfaction and have averaged 180 hours burning for each electrode and we find that the lamps burn out very uniformly, as report from lamps burning out even after 180 hours is an exception.

W. T. BLACKBURN,
City Engineer and Superintendent of Municipal Electric Light and Water Works, Paris, Ill.

MR. PARKES: There is a question I want to ask. We have a contract with a company requiring them to furnish a certain amount of illumination, 1200 candle power per arc lamp. I understand I am exposing my ignorance in asking for this information, but can any one tell me how I can ascertain definitely whether or not they are furnishing that candle power in an arc lamp, say 1200? Can I put a voltmeter on the lamp and find out?

MR. WEISSLEDER: You can place a voltmeter on the terminals of the lamp and get the potential across the arc, and when there is a fall of

potential, you, of course, know that energy is going through. When you put the ammeter on the lamp and measure the amperes, that will give you the electrical energy that passes through the lamp, and with good carbon, not too hard and of not too high resistance. you will get the useful illuminating effect from that amount of energy. All the later specifications require in the matter of lighting that the energy to be passed through the lamp be expressed in watts. That is the better way, and thus you are in a position to require proof from the contractors that they are giving what they agree to give. You will find it hard to say that they are giving 1200 or 1000 or 600 candle power. That is one of the most difficult questions engineers have to cope with today; in fact it is acknowledged by all that the matter of candle power is one of expression only.

MR. HOWARD: Have you a substitute expression that can be used instead of this antiquated expression "candle power"? Of course horse power is also absurd. It has nothing to do with a horse.

MR. WEISSLEDER: Simply use the time worn expression in a figurative sense. Name the wattage to be consumed by the lamp, the electrical energy expended around the terminal of the lamp.

MR. HOWARD: Can you not define what the carbon shall be of this wattage and amperage?

MR. WEISSLEDER: That is not taken into consideration because the companies supplying the current aim to get carbon of uniform resistance so as to get a maximum amount of light out of the electrical energy.

MR. HOWARD: Can we not dictate to them the carbon to be used?

MR. WEISSLEDER: We can determine what the wattage is which they must supply, and then we can take the schedule of lighting hours and in that way determine whether the company is living up to its agreement by installing recording watt-meters at the generating plant which gives a permanent record on the dial.

MR. HOWARD: Couldn't you get at the requirement of what the lighting power of the lamp should be? We do it in cements; why shouldn't we do it in electric lighting? Now what could be used, stating it in a general way. to show what requirements the corporations and municipal plants should meet?

MR. WEISSLEDER: Put it entirely on the ground of consumption of electrical energy at the points of the carbon. By doing that it will bring the public and everybody else up to know what it means. You point to an incandescent and say it consumes 1 watt. What is that? That is a unit of electrical energy. We must educate the public along this line.

We are still in the school of instruction, passing from the position ordinarily occupied by the electric light promoter to that of the consumer who has to deal with the hard facts, to pay for some commodity, and there must be some understanding acquired on the subject in that way by simply using the term "the electrical energy used in the lamp."

MR. HOWARD: You use the expression 1 watt per candle power. Why can you not substitute for candle power, say ampere?

MR. WEISSLEDER: No, because that is a technical expression.

MR. HOWARD: Well, you must get into technical expression. You can no longer use the ordinary expressions in this connection. I know of nothing to substitute.

MR. BROWN: It seems to me that what Mr. Weissleder is selling is electrical energy, and what the city wants to buy is illuminating power, a certain amount of light.

MR. WEISSLEDER: That is right.

MR. BROWN: If my statement about Paris, Ill., is true and they are getting better light now than before, they are getting it with less expenditure of electrical energy, and it seems to me from the city's standpoint what we want is some measure of the luminosity rather than the electrical energy, and that, as I understand Mr. Howard, is what he is trying to get, and that is what we all want. I know the National Association of Illuminating Engineers have been working on it, and they have been objecting very strongly to measurement in wattage, just as strenuously as to measurement in candle power. They have not been able to give us anything yet, and perhaps we should co-operate with them.

MR. WEISSLEDER: In reply to Mr. Brown's remark about luminosity and electrical energy, I would say that since electrical energy is convertible into light, it seems to me there should be no trouble in having it in electrical energy, because whoever furnishes the current understand that the energy as contracted for must be supplied, and I haven't the slightest doubt that every company is supplying what they have obligated themselves to supply.

MR. BROWN: That would be all right if you were specifying a definite lamp.

MR. WEISSLEDER: The specifications should be drawn up by those in authority who have to do with that subject whenever a contract is about to be made, and of course if there are members of council who are not familiar with that subject, if they will call into consultation a competent man familiar with that subject, no doubt they could frame up something satisfactory. The citizens would certainly stand back of the

council if it incurred any expense in getting these facts and information. In the engineering line we have to pay for that information, for that expert advice, and electrical engineering is not far removed from other lines of engineering.

THE PRESIDENT: I understand that while the Electric Light Association has been wrestling with this problem for several years, they are not satisfied to agree upon any form of substitution for the present methods. They have been working on what is called a luminometer, some sort of a box arrangement by which you can get an idea of the amount of lighting power of nearly horizontal rays of light, and can compare one light with another by finding what distance you can walk away from the light and still read cards of a certain sized type. That instrument I have tried and I find that it depends very materially upon the personal equation, and I think that is the objection the electric companies find to such a method of measurement. It depends a good deal on the eyesight of the individual who is using the luminometer.

From some of the remarks made it would seem that without question the newer form of light is the one to be used for economy as far as the lighting of the city is concerned, but there is one phase of the question not covered so far by this discussion, namely, that the newer form of light costs a good deal more for installation than the open arc or the present enclosed form of lamp. The magnetite lamp, I believe, costs about $50.00 per lamp as against $18.00 for the other style, so that in any city having a large number of lights, the installation will be a large item. For example, on the basis of about 3,000 lights you will see that the installation of new lamps throughout the entire city means an additional investment in the plant of somewhere around $100,000.00, and of course the operation of the plant must be sufficiently economical to pay the added fixed charges due to this additional investment. It would seem, however, that with the amount of energy saved by the new light, there could be no question but that this additional investment would be justified, but I understand from a discussion of the subject with some of the companies that the difficulty with this problem is, that while the operation would be sufficiently cheaper to warrant the added investment, still the state of the art is such that the companies hesitate to install a new light until it has been tried out or until they have satisfied themselves that there will not be a better light in the market within a reasonable period. So other factors besides apparent economy of the light itself must be considered.

GENESEE STREET, AUBURN, BEFORE REMOVAL OF WIRES.

GENESEE STREET, AUBURN, AFTER REMOVAL OF WIRES.

MUNICIPAL ELECTRICAL CONDUIT SYSTEM

OF THE CITY OF AUBURN, N. Y.

By J. Walter Ackerman, City Engineer.

In the year 1901 the City of Auburn granted to one, John Flanigan, a grant or franchise enabling him to build and operate electrical conduits in the City of Auburn, within certain street limitations; provided, however, that after those certain street limitations had been built, he was then to have the right of extending the conduits in other streets. But it was also subject to the provision that if the City of Auburn desired said John Flanigan or his successors to build a conduit in a certain street, and gave him due notice thereof, if he did not construct within a certain time his right in such street lapsed. It also contained a provision whereby the city could purchase the conduits after a lapse of twenty years.

An incorporated company, known as "The Auburn Subway & Electrical Company," whose principal stockholders were interested in the local lighting company in the City of Auburn, was the successor of John Flanigan, and in 1901, 1902 and 1903, they constructed approximately four miles of conduit, which contained about 250,000 duct feet. This conduit was built by placing the ducts carrying the high potential wires on one side of the street, with its manholes and appurtenances, and the ducts carrying the low potential wires were placed on the opposite side of the street. This form of construction was at that time common, and was built in the City of Auburn in that way. The distribution was radial, rather than block distribution, with the wiring for distribution running in iron pipes, to the different buildings in a radial direction and depending upon securing the rights from various property owners to carry the different circuits from basement to basement. A part of this construction was through pavements already laid,

only a small portion of it being laid in the streets prior to the putting down of the pavements. This, together with the fact of its being built on the double system, made the expense of the conduit quite a serious proposition; and in 1905, the company refused to make any extensions, and therefore surrendered their right to build any further conduits where the city requested them so to do. And then the city, thinking that it could build and own its own subways, and derive a benefit therefrom, both financially and by getting the wires underground, applied to and received from the legislature of the State of New York a special act, being chapter 475 of the laws of 1905 of New York, authorizing the city to borrow money and issue its bonds for the purpose of constructing electrical conduits in its streets, highways, alleys, public lanes and squares of said city.

This special act provided that the common council was authorized and empowered to designate such street or streets or parts thereof in which the conduits should be built. The process of getting to and building the same is as follows:

After the common council has designated the street or streets, the next step is the making of plans and specifications by the city engineer. A public hearing is given on same, and then proposals are invited for the construction of said conduits. After the contract has been awarded the matter is turned over to the city engineer to construct. After a number of these conduits had been built and installed, the system was turned over to the office of the city engineer to care for the renting and assigning of space for the location of the cables for each of the renting companies, and for the formulation of certain rules and regulations for operating the same, and of a lease for the public service corporations to make out whenever they wished to use any of the conduits.

The city now owns, in four of its streets, a total of 259,256 duct feet of conduits, the total cost of which was $50,400, making the average cost per duct foot at 19½ cents. The duct feet actually rented at the present time amount to 68,387,

MANHOLES OF AUBURN CONDUIT SYSTEM.

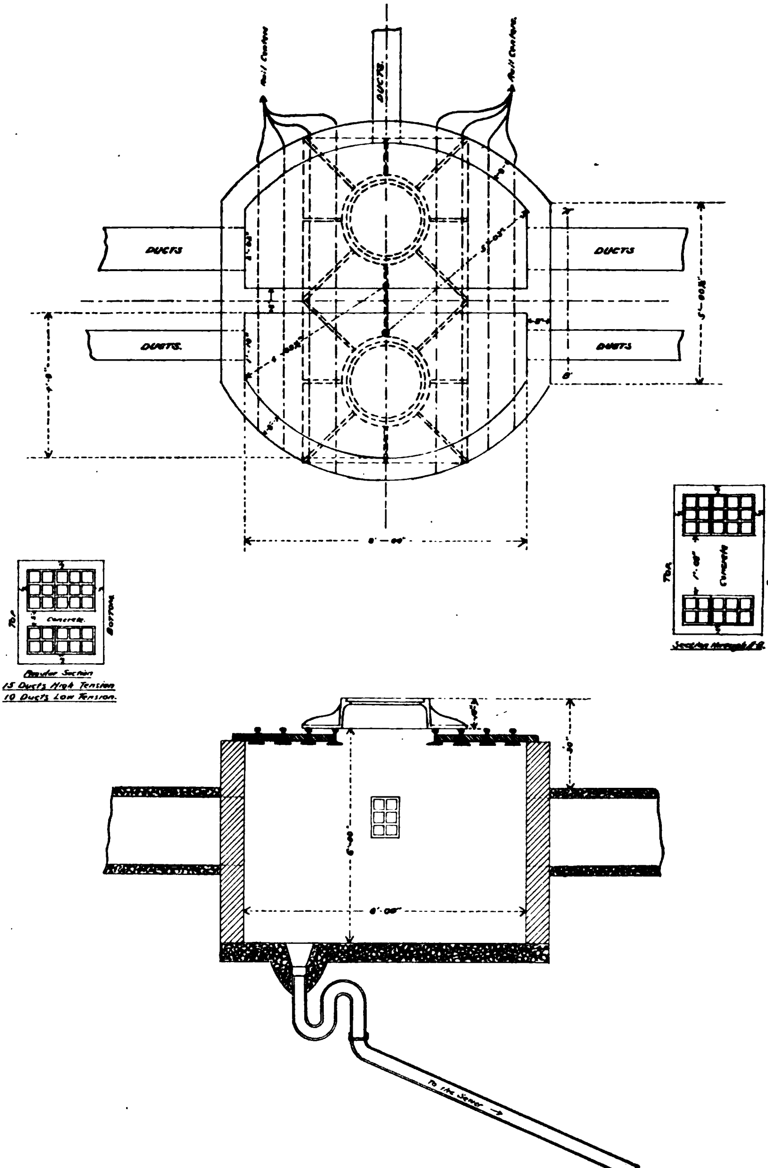
on which a rental of 5 cents per duct foot per annum is charged, amounting to $3,419.05. But the fact that about 150,000 duct feet have recently been constructed, in which but a very few feet of cable has been installed, is the reason for this small percentage of occupancy. When all of the wires which are at present in use for service are put into the conduit, there will be in use a total of 96,688 duct feet, which, at the rental of 5 cents per duct foot per annum, will amount to $4,834.40.

A part of the bonds issued for the construction of this improvement has been floated for 4 per cent, and the later bonds have been floated for 5 per cent, so that the city is now paying $2,230 interest on the investment.

One inspector is employed by the year at $300. He does this work whenever called upon, being such times as when cable is installed or splices made, or any other similar work required, (and his daily pay amounts to a good fair sum), so that the total fixed expense is $2,530 per year.

While it cannot be said that there are no maintenance charges, so far they have been very low. I think the entire amount has been less than $50 since the first conduit was built. But assuming that it may amount to as much as $300 per year, the city would then receive $2,000 per year over and above all expenses to apply on the funds to retire the bonds.

A word as to the design of the conduit. All of the conduits are what are known as the Vitrified Multiple Duct Conduit, varying from a minimum of six ducts per conduit to fifteen. The conduits carrying the low potential wires and the conduits carrying the high potential wires are both placed in the same trench, being separated by a wall of concrete five inches in thickness. The remaining part of the conduits are surrounded by a concrete wall three inches in thickness. The manholes are built double; that is, there are two separate heads, one going into the high potential side, and the other going into the low potential side, with a tight brick wall in between them. In other words, the two conduits are as distinct and separate as if they were on opposite sides of the street. This manner



STANDARD DOUBLE MANHOLE.
AUBURN MUNICIPAL CONDUIT SYSTEM
AUBURN, N.Y.

MANHOLE, SHOWING DISTRIBUTION PIPES.

CLARK STREET, AUBURN, SHOWING NEED OF CONDUITS.

of construction we found lowered the cost at least 50 per cent, and is just as practical as the other form. The distribution is through 3-inch iron pipes, and is both block and radial.

The lease is a continuous one, and as long as no change is made in the occupancy the public service corporation receives, about fifteen days before it is due, its quarterly bill for a certain number of duct feet.

At the time the city first took up the proposition of a municipal electrical conduit system, there were in the City of Auburn two telegraph companies, two electric lighting companies, two telephone companies, and two electric street railroad companies. The two lighting companies have since consolidated, but it has not decreased the number of duct feet which they rent. The original intention was to design all of the conduits so that the present occupancy would take about 50 per cent of the ducts, leaving 50 per cent for future development. We find, however, that the companies try to economize in every way to reduce the number of duct feet which they use, by—in the case of the telephone companies—buying the largest cable that will go into the duct; and the lighting companies take chances on their arc circuits of pulling in cables of quite a different potential into the same duct. So that when all the wires in our present conduit district are in the conduit, it will only amount to about 37 per cent of the total capacity of the conduit. However, our special conduit act prevents the city from realizing more than 10 per cent of the entire cost of providing, constructing, equipping, maintaining and operating said conduits and appurtenances thereto. So that you will see that unless some unforeseen contingencies arise whereby our operating and maintenance charges are greatly in excess of the present rate, we will have to reduce our rental per duct foot to come within the limitations of the statute.

In order to make our system effective, the state legislature gave us the following provision:

"The common council of the City of Auburn shall have the power to control the erection and removal of all telegraph,

electric light or power, and telephone poles, wires, cables, and other electrical conductors in or adjacent to all streets or parts of streets in which such subways or conduits shall have been constructed, and to direct and require that all such wires, cables and other electrical conductors heretofore or hereafter erected or constructed be placed in said subways or conduits constructed in the streets of said city within a reasonable time after such direction, and a compliance with such direction and requirement may be enforced by mandamus or other appropriate remedy in any court of competent jurisdiction, upon the appliance of the city."

A word as to the other conduit system mentioned in the opening. I will say that on account of its method of construction and of the fact that they had to build through a part of pavement, and to the fact that their franchise tax of the state amounts to about $2,500 a year, makes their rate of rental much higher than that of the city. Hence all the public service corporations are more anxious that the city continue to make extensions of its conduit system than to allow the extension of that of a private company.

DISCUSSION.

MR. RUST: I would like to ask how they arrive at the rental?

MR. ACKERMAN: The rental was arrived at by writing to every known municipality operating a municipal conduit system, in both the United States and Canada. We found that 5 cents was the lowest rate in any city that we got any information from, and as 19½ cents per duct foot is what ours has cost, that seemed to us a pretty fair proposition, and in a conference with all of the public service corporations they all said they were willing to pay 5 cents per duct foot per year.

MR. RUST: I would like to ask if all your rental is flat rate?

MR. ACKERMAN: It is, regardless of the amount or the size of the cable. We simply assign a certain duct to a certain company whether it is 3,000 feet, or 5,000 feet, or 10,000 feet, we make no difference.

MR. PUTNAM, of Rochester, N. Y.: Suppose that a private owner of an isolated plant wants to run a wire for a single block, it simply paralyzes one duct then all the way through the street.

MR. ACKERMAN: That has never happened to us. As I previously stated, we will, at the present time, with all the wires in the conduit, occupy only about 37 per cent of its total capacity.

THE PRESIDENT: Could the city now install a systematic outlay of conduits without acquiring those in the streets belonging to the several public service corporations?

MR. ACKERMAN: The original franchise granted the former conduit company allows us to buy their conduits so there is no reason for our planning to build conduits where they have them.

REPORT OF COMMITTEE ON SEWERAGE.

Chairman, C. H. Rust, City Engineer, Toronto, Ont.

From the Annual Proceedings of the Society it has been ascertained that no reports from this committee have been made since 1902 when Professor Folwell, the then chairman, presented a very valuable report dealing more particularly with sanitation.

Your committee proposes, very briefly, to review the more recent investigations made in the method of treatment and final disposition of sewage.

Experiments have been steadily progressing, both in the United States and Great Britain, dealing more particularly with the treatment of sewage upon filter beds.

In Columbus, Ohio, through the efforts of Mr. Griggs, who was then city engineer and is a member of this Society, a valuable series of experiments was carried out, and as the result of these investigations the experts expressed a preference for trickling filters. The result of this work has been of incalculable benefit to engineers and municipalities. We only refer briefly to this as no doubt the members of the Society have had an opportunity of reading the full report upon the results of these experiments.

While a number of small places dispose of their sewage by septic tanks and bacteria beds, no large plants similar in magnitude to those at Birmingham and Manchester have as yet been installed in America.

From the experience in England it appears that much better and more satisfactory results are now obtained from filter beds. Where the sewage is either distributed by revolving sprinklers, or by jets, it has been found that a much greater quantity of sewage can be treated per acre by this method than by the contact beds; and while at Columbus, from the results of the experiments, it has been decided to distribute the sewage by

means of jets, we doubt very much whether this method of distribution will be a success in the more northern parts of this continent.

When septic tanks were introduced a few years ago we were assured that the sludge problem had been solved. This unfortunately has not proven to be the case, and, while the introduction of septic tanks has minimized to a very large extent the sludge problem compared with the former system of sewage by precipitation, there is still a considerable amount to be dealt with.

The chairman of this committee last year had an opportunity of visiting some of the more important and larger plants in Great Britain, amongst others the Birmingham Disposal Works, situated in the Tame Valley, and in charge of Mr. John D. Watson, an engineer of very great prominence in this branch of the profession. Mr. Watson has fortunately been able to devote both time and money in experimenting with various methods of disposal.

At the time of the visit the total flow of sewage distributed to the works, which contain about 2,800 acres, was twenty-five million gallons, of which seven million gallons was treated in detritus tanks, septic tanks and beds. The detritus tanks were cleaned out weekly. Some of the septic tanks had been in use for two years without any sludge having to be removed.

It has been considered by many engineers and others that the sludge from the septic tanks would create a great nuisance if put upon land, but this has not been found to be the experience at Birmingham, where the chairman had an opportunity of observing large piles of this material which had recently been deposited on the land and which was quite inoffensive.

All the sewage treated goes through two septic tanks. Mr. Watson expressed an opinion that from twelve to fifteen hours is quite sufficient for septic tank capacity.

Of the various kinds of filter beds in operation upon the works, some of them disposing of one million gallons of sewage per acre, Mr. Watson expressed a preference for the distribution by means of jets, the beds being six feet deep and covered

with six-inch pipe six inches apart, and the jets are placed six feet apart in rows and operated under a head of two feet. Mr. Watson also expressed an opinion that not more than fifteen million gallons of strong sewage can be purified upon the 20-acre filter beds in operation at these works.

Mr. Watson is a firm believer in coarse beds and takes through some of the beds as much suspended matter as is put in them. The beds have been in use from two to four years without renewal. These beds cost about $30,000 per acre.

Mr. Watson is also very strongly in favor of open tanks and is satisfied that septicized sewage can be placed upon the land without creating a nuisance.

It was very pleasing to observe at Birmingham the manner in which the grounds in the vicinity of the tanks had been ornamented by means of flowers, shrubs and grass plots.

At Manchester, where formerly the sewage was disposed of by chemical precipitation, there is now in use a very large installation plant treating their sewage with septic tanks and contact beds. They have 46 acres of primary beds and 26 acres of storm beds, but they find that one set of contact beds does not give a satisfactory effluent sufficient to meet the requirements of the River Board, and they are now arranging to put in a secondary set of beds.

The annual cost of operating these works is about eighteen cents per head of population, not including any capital charges. Between 25 and 30 thousand gallons per twenty-four hours are dealt with. The contact beds treat 600 thousand gallons per acre.

It has been found that there are from four to five grains of suspended matter in the primary beds and 1.5 grains per gallon of suspended matter in the secondary beds. It takes one hour to fill the beds and the sewage stays in one hour and empties in one hour. The beds are filled three times per day.

It is estimated that 35 million gallons of sewage would yield about fifty tons of solid in twenty-four hours. It was also ascertained that the primary beds gave about seventy-five per cent of purification and the secondary beds ninety per cent.

Mr. Arden, the chemist, also informed me that to avoid after-putrefaction they should get at least 80 per cent of purification. For some of the beds which have been in use three or four years they have been re-washing the filtering material, which costs about thirty-five cents per ton.

Mr. Arden also gave me as his opinion why the primary beds were not so satisfactory, that they are not sufficiently drained.

There has been printed during the past few years an enormous amount of literature dealing with sewage disposal. Two papers which are especially interesting are the following, which were printed in the Surveyor, a London publication, one dated January 5, 1906, entitled "The Present Phase of the Sewage Question," by Mr. Reed, and the other dated July 6th, 1906, entitled "Sludge Treatment in Relation to Sewage Disposal," by Mr. John D. Watson.

The English Local Government Board requirements in regard to the capacity of proposed sewage disposal works have been very much discussed for some years, and while the board has been subject to a great deal of criticism, it appears, after a number of years of practical experience, that their requirements, which were condemned by many as being excessive, while conservative, has been found on the whole to be fairly satisfactory. The board, however, does not appear to have made any distinction between the variation in the character of the sewage, having always insisted upon provision in all cases of one square yard of filter one foot in depth for every fifty-six gallons of sewage to be treated.

We have referred in a previous part of this report to the fact that Mr. Watson found that 20 acres would purify 15 million gallons. Mr. Hart, as the result of experiments at Leeds with settled and septic sewage, found that 63 gallons per cubic yard per twenty-four hours was the volume satisfactorily treated. Of course both these cases refer to the dry weather flow. The local government state that the volume of sewage, including rain fall, to be treated per cubic yard in twenty-four hours, is 168 gallons. At Birmingham the actual volume satis-

factorily purified was 158 gallons and at Leeds the volume was 126 gallons per cubic yard in twenty-four hours.

With regard to the capacity of the septic or sedimentation tanks, their requirements are now considered to be too high. At first all tanks were designed for a capacity equal to one and a half times the daily dry weather flow. This was later reduced to one day's dry weather flow. A number of engineers are now satisfied that 12 to 15 hours is sufficient.

In England the chairman visited two or three works where open tanks gave off a very offensive odor. This can probably be attributed to allowing the sewage to remain in the tanks for too long a period.

One of the largest and most comprehensive works up to the present time proposed for the treatment of sewage in the United States is in Baltimore, where, in a recent report made to that city, Messrs. Hering, Gray and Stearns recommend the adoption of septic tanks and sprinkling or percolating filters.

The Royal Commission on sewage disposal, which was appointed in 1898, have not as yet presented their final report, but have forwarded four interim reports. For the past two years, however, nothing has been heard from it. Its enquiries, however, are costing about $23,000 per annum, and it is to be regretted that such an important commission has not yet been able to bring in a final report.

In the construction and design of sewers there has not been very much change during the past few years, except that the use of concrete is, we think, gradually taking the place of brick for sewers of large dimensions. A great deal more information is also required as to the size of the sewers where the combined system is in use. There is still a great deal of flooding caused by the insufficient capacity of sewers, especially in cities with a large percentage of paved streets, and your committee think that the members of the Society could do a great deal of valuable work by keeping records of the rain falls and run-off. While a good deal of literature has been printed upon this subject, we feel that further experiments are advisable.

SEWERAGE SYSTEM AND DISPOSAL WORKS,

KEW BEACH, TORONTO.

By C. H. Rust, City Engineer, Toronto, Ont.

That portion of the city known as Kew Beach is situated at the eastern limit on the shore of Lake Ontario and is solely a residential district. The level of the ground is only a few feet above the level of the lake and the soil sandy underlaid with clay.

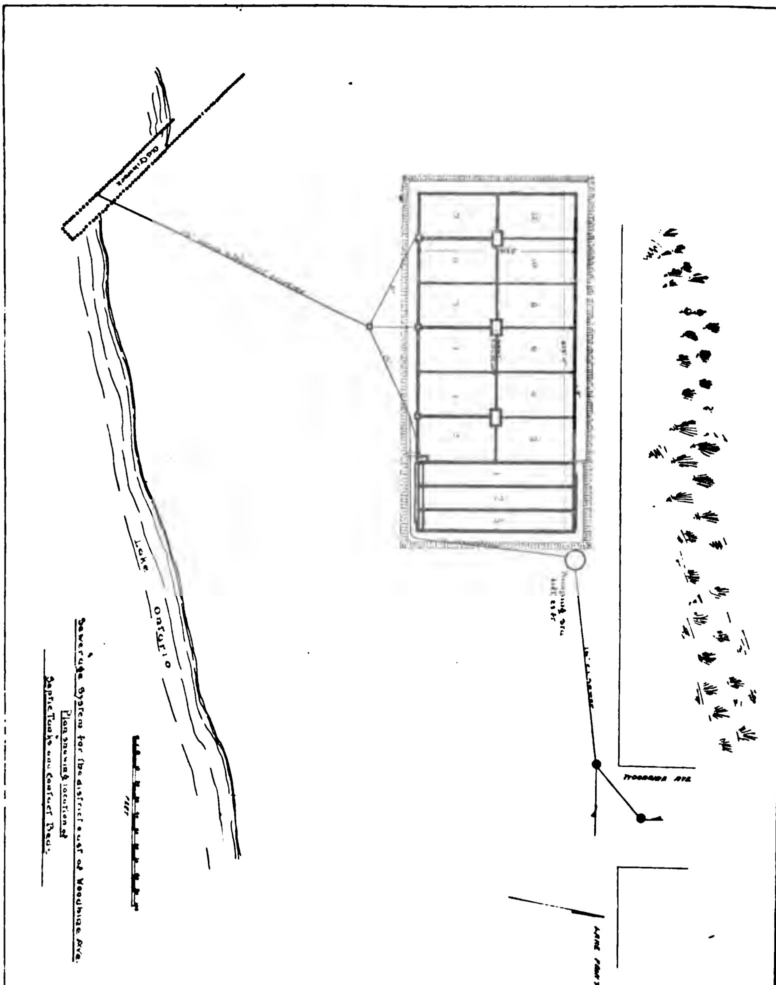
The property owners have been for some time asking for drainage, but owing to the municipality of East Toronto procuring their water supply from a point about three-quarters of a mile east of this district, and to the objection of the Board of Health to allowing crude sewage to be deposited in the lake, it was necessary to adopt the sewers and purification works as described. The drainage area of this district is one hundred and eighty-five acres, containing a population of approximately 10,000 during the summer months.

To ascertain the consumption of water a meter was placed upon this district and it was found that the actual consumption per head in twenty-four hours was sixteen gallons.

SEWERS.

The main sewer is laid along the lake front at a depth varying from 2 feet to 9 feet below the lake level and is constructed of 16 inch and 10 inch cast iron socket pipes. All sewers from the north discharge into this sewer, and at a point midway between the outfall and the summit is constructed Pumping Station No. 1, raising the sewage from the low level sewers from the east and north into the high level sewer, which gravitates to No. 2 pumping station, where the sewage is raised into the disposal works. These pumping stations are constructed of concrete and are circular in plan, with a partition

wall in the center, and have a reservoir space of 3,200 gallons; and each contains a duplicate set of pumps and motors, No. 1 consisting of two 5 H. P. alternating vertical motors and two 4-inch submerged centrifugal pumps, and No. 2 consists of two 7½ H. P. alternating vertical motors and two 4-inch submerged



PLAN OF DISPOSAL GROUNDS AND OUTLET, KEW BEACH, ONTARIO.

SEPTIC TANKS, CONTACT FILTERS AND PUMPING STATION, KEW BEACH.

centrifugal pumps. Motors and pumps are automatically controlled by the rise and fall of the sewage in the reservoir.

The shafts of the pumps are connected direct on to the armatures of the motors without any bevel gearing, which practically eliminates all noise whilst operating.

SEWAGE DISPOSAL WORKS.

The Disposal Works consist of three septic tanks and twelve bacteria beds, constructed from plans designed by the Cameron Septic Tank Company and operated by the gear patented by them.

The works are erected on the shore of the lake about 200 feet from the water's edge, and are supported by 10-inch piles driven 16 feet through the sand and into the hard clay, and surrounded by tongued and grooved sheet piling driven 14 feet.

The construction of these works is of concrete in the proportion of seven of broken stone and sand to one of cement.

The three septic tanks are each 100′x14′x7′ 3″ deep at the low end, with a total capacity of 183,750 gallons. They are covered with a 3-inch concrete roof, made in the proportions of 4½ of broken stone and sand to one of cement, and reinforced with 3-inch mesh, 10-guage expanded metal. At 6 feet 6 inches centers are 9x6 inch concrete beams supporting the roof, reinforced with ¾-inch Johnson's corrugated steel bars. An inlet channel feeds the three tanks at the high end, each one of which can be operated independently from this channel.

The distribution of sewage into the tanks takes place through one 8-inch pipe, thence through four 12-inch openings, three feet above the bottom of the tank, which accomplishes a maximum flow of sewage with a minimum amount of disturbance. At the low end of the tanks thirteen 4-inch outlet pipes are built into the wall, 2 feet 7 inches below the water line, connecting with the cleansing chamber and outlet channel. From here the main effluent carrier is built into the wall of the bacteria beds in line with the outlet channel of the septic tanks and runs the

whole length to the end of the beds, and has three branches at regular intervals, each feeding one set of four beds.

There are 12 bacteria beds, 3 sets of 4 each, having a combined area of 1,860 square yards. Each bed is 50′x28′x4′ 6″ deep and is filled four feet deep with furnace slag varying in size from 1/4 to 1 1/2 inches. On the floor are laid 14 lines of 3-inch weeping tile collectors, discharging into a 9-inch main collector; and 6 inches below the surface of the slag are six lines of 6-inch weeping tile distributors fed by a 9-inch main distributor. All discharge pipes terminate in one common chamber from which a 15-inch main filtrate carrier is laid down to the lake, the last 30 feet being supported on piles.

OPERATION.

The sewage is raised to a height of 22.5 feet at Pumping Station No. 2 into the inlet channel, which is below water line and extends to a point beyond the inlet to septic tank No. 3. From this inlet channel the sewage is admitted into each tank required to be operated through the submerged openings.

The effluent from the tanks flows through the submerged outlets and through the effluent chamber, which arrests any solid matter which may find its way through the outlet pipes in time of excessive flow, and thence into the outlet channel.

The semi-clarified sewage now flows along the main effluent carrier and on to the automatic distributing gear, from which it is distributed to each bed in turn through its admission valve. The discharge valve will be closed meanwhile so that the interstices of the filtering material will be filled with the tank effluent. The effluent remains in the contact beds for a period of about two hours, according to the rate of flow. The discharge valve will then open, when the filtered effluent escapes, drawing down after it a supply of air into every crevice of the contact bed. The latter will then drain and aerate whilst the remaining contact beds of the set are filling, after which it will again be filled in turn. This method of working renders the

contact beds self-cleansing so that they retain their purifying power unimpaired.

The alternate filling and emptying of the contact beds is effected automatically by means of the alternating gear in the following manner: As soon as bed No. 1 is filled, a small quantity of filtered effluent overflows from its discharge well into a float chamber, lifting the float, at the same time opening the admission valve and closing the discharge valve of bed No. 2. When bed No. 2 is filled, this operation is repeated, the flow of tank effluent diverted into bed No. 3 and the discharge valve of bed No. 1 is opened and its contents allowed to discharge.

The construction involved the carrying out of 12,262 feet of 9-inch pipe; 1,569 feet of 12-inch pipe; 1,349 feet of 15-inch; 2,451 feet of cast iron pipe; 32 manholes and 982 junctions. The average depth of the sewers was 8 feet 9 inches. A great deal of the work was in sand charged with water, involving constant pumping.

The costs of the works was as follows:

Sewers and pumping stations	$37,755
Pumping plant	3,185
Disposal works	13,079
Piling, etc.	5,119
Slag, 2,500 cu. yds. at $1.50	3,750
Automatic distributing gear	4,000
	$66,888

It was found, after the slag had been in the beds some time, that about ten per cent of settlement took place. The works have been in operation since April and the effluent so far has been very satisfactory.

PHENOMENA OF THE CRUSHING OF SEWER CONDUITS.

By James Nisbet Hazlehurst, Consulting Engineer.

During the year 1894 the writer's experience with the breaking and failure of sewer pipe commenced, when as superintending engineer for a contracting firm constructing some forty miles of sanitary sewers in a southern city, he was required to remove and relay a line of 24-inch double-strength pipe, laid at an average of 15.5 feet, through clay soil, with trench foundations considerably "mucked" and saturated.

There was no collapse of any of these sections, but an internal inspection revealed the fact that many of them had cracked, and, after uncovering, they were found generally quartered, 150 feet in one continuous length being so discovered. Along the sides and under the haunches, extending up about six inches, in a monolithic line, concrete wedges had been required; and the damage was attributed to the rigid support, pivoting the pipe lengths, to the general character of the subfoundation, and to the weight of the saturated clay used in refilling, although in the light of subsequent experience the correctness of this hypothesis may be questioned.

Four years later, as chief engineer of the municipal improvements at Tampa, Florida, consisting of a considerable amount of paving and the construction of some thirty miles of sanitary sewers, the writer was again called upon to investigate the breakage of a large amount of vitrified sewer pipe under rather peculiar conditions.

The design of this system had been made by Col. Geo. E. Waring, who had also furnished plans and specifications for similar work for the cities of Brunswick and Savannah, Georgia, shortly before, the former having been completed and the latter being then under construction.

At both of these places serious defects had been reported in the sewer lines of from 18 inches to 30 inches in diameter, requiring the removal and replacement of very considerable quantities of pipe, in some instances the substitution being made with cast iron pipe of similar diameters.

After a careful study of the proposed plans and specifications, and prior to advertising for proposals at Tampa, because of his past experience and the knowledge of the situation both at Savannah and Brunswick, the writer deemed it expedient to lay these matters before his board of public works, and recommended to them a change of specifications which would include the substitution of cast iron pipe mains for the heaviest work, which averaged some 14 feet for several miles.

Owing to increased expense the board declined to permit this, and even refused to allow a change from the standard thickness to the so-called double-strength vitrified sewer pipe.

Protecting himself against personal and professional liability for work done under these conditions through insistance that full record of that meeting be made, the writer advertised the work and commenced active operations shortly thereafter.

At that time the Florida state board of health was rigorous in its insistance that all work of underground construction should be strictly limited to the winter months and that no work of this character should be permitted from June 1st to October 1st of each year, under the supposition that malaria and yellow fever might be attributed to miasmatic emanations from freshly turned earth, so that, within the limits stated, all work was suspended.

As is usual, the outfall sewers were those first commenced, and these were laid in a sandy, saturated soil of the usual coastal type, continuous sheathing and bracing being required, and timber foundation generally used; and at the close of the season all lines were securely protected by bulkheads and otherwise.

With resumption of work the lines were opened and drained by pumping, when, to the dismay of the entire staff, many of

the sewers were found running full-bore with abnormal infiltration of ground water.

Upon uncovering and stripping, long stretches of the larger mains were discovered to have broken in longitudinal slabs, falling apart as the work was opened up.

These facts being duly reported, after a lengthy negotiation with the contractors, removal and replacement of the damaged sections was agreed upon and executed, cast iron pipe, as originally suggested, taking the place of the standard vitrified material.

The exact figures of quantities and costs are not at hand, but the increased expense was extreme, since the contractors took advantage of the situation to demand prices out of proportion to what they would have charged under original bids, the change being so radical as to destroy the value of the first contract, which, it is fair to say, had been a losing one to the contractors, and very considerably below the cost estimate of the writer.

In connection with a piece of work differing in nearly every respect from the conditions cited, but with large damage primarily attributable to the failure of the vitrified pipe of the larger sizes, the writer has very recently been retained by a contracting firm to determine, if possible, the cause of the trouble, and to make proper presentation of their side of the controversy, and this late investigation is largely responsible for the presentation of this article.

The work mentioned included several contracts aggregating $114,500.00 in an important southern city where all work had been completed according to the contract terms, and, being ready for acceptance, a final inspection revealed the following lengths of damaged pipe:

70 feet of 15-inch sewer,
450 feet of 18-inch sewer,
115 feet of 20-inch sewer,
560 feet of 22-inch sewer,
1,076 feet of 24-inch sewer,

or a total of 2,251 lineal feet of sewer from 15-inch to 24-inch in diameter; the loss entailed in replacing this pipe approximating $7,000.

The city engineer maintained that as the specifications called for the "best quality of vitrified clay pipe," this material having failed under the conditions to which it was subjected, was manifestly of inferior quality, and he required that this be replaced with suitable material at the contractors' expense.

Tests made of this material both by the writer and the manufacturers showed this pipe to have been of good average quality, and capable of resisting far greater loads than those applied under actual conditions, the maximum depth under which the pipe failed being 23 feet, while the greatest damage appeared in trenches of insignificant cover.

The trenches in which these sewers were laid were cut in a firm, clay soil, the walls standing at the perpendicular without sheathing or bracing, the foundations being entirely free from ground water, and under these ideal conditions, of 4,234 feet of 24-inch pipe laid, practically one-quarter was damaged as stated, and had to be removed.

By elimination, the theory of this damage advanced by the writer and maintained by the contractors was that the cover required over the top of the pipe was insufficient for proper protection, since only six inches of loose earth was permitted above the barrel of the pipe before ramming was required, the tool used being specified to weigh not less than 40 pounds, with an 8-inch square face. With this implement, the loose earth readily compacted to 4 inches, leaving only 2 inches above the bell of the 24-inch pipes, where exact depths of cover had been secured.

That the engineer was himself at least suspicious that the damage arose through the light cover specified, in connection with the unusual ramming implement, was shown by a change in the requirements for a subsequent contract to the same firm, and in which he reduced the weight of the tool to 30 pounds

and increased the depth over the pipe before ramming to 12 inches. Under the new conditions, upon final inspection, not a single joint of pipe was found to have failed.

Under these contracts the engineer had been most insistant upon the thoroughness of refilling and ramming, and his entire staff was repeatedly cautioned and instructed to demand a most unusual thoroughness in the matter of refilling, the effort being to replace all excavated material after pipe laying.

The contract requirements as to liability for negligence and for the use of defective or improper materials was particularly onerous in these cases, beside which a maintenance or guarantee clause was relied upon to cover all possible omissions or errors from whatever cause, but in our contention we relied upon the fairly well established legal precedents that when a contractor has undertaken to construct works in accordance with the plans and specifications furnished by the owner, and has faithfully executed such work in compliance therewith, and in a skillful and workmanlike manner, he is not liable if it fall, fail or prove worthless; and further, that a guarantee clause is not to be construed so as to make a contractor liable for the failure of the work to remain in good repair when the plan or design was defective.

While we insist and believe that in all equity and fairness we should not be held liable for this damage and loss, the settlement of the case is far from being reached, and a recitation of these several failures occurring within the experience of the writer, and omitting the many well authenticated and unfortunate experiences along the same lines by others, brings us face to face with a necessity for an investigation of the current practices in the design and construction of sewerage systems, and the correct determination of the choice of materials and the elements of construction; while, from the last case cited, we must infer that an excess of zeal in an insistance in the matter of securing a proper support about several lines may bring about results as unfortunate as those attributable to negligent methods. Hence it would seem that, as with the

Presbyterian dogma of predestination, "one is damned if one does and damned if one don't," and having learned these things practically, it behooves us to take council of ourselves and of each other; therefore let us reason together upon the probable causes of these troubles and seek a possible remedy.

Earth Pressures.

Since the stress to which sewer conduits are subject is largely external, and dependent, both as to intensity and direction, upon earth pressures, we will commence our investigation at the fountain head, and omitting the well known Rankine formula, assume his deduction that the horizontal pressure cannot be greater than three times the vertical, nor less than one-third this, the variability depending upon the angle of repose of materials under different circumstances, the conclusion being that while there is a mathematical theory of the combined action of friction and adhesion, for want of precise experimental data its practical utility is doubtful.

This is practically the beginning and the end of the matter, since despite the mass of existing literature upon the subject, many beside Sir Benjamin Baker, of the British Institute, have found it "both misleading and disappointing," and agree with practical John Trautwine, "That it would be better to cease from circulating such evident mistakes," since he had found that while dry sand might be cuoquetted into assuming certain angles of repose upon laboratory tables, in practice it would stand at "no less angle for a savant than for anybody else."

Many efforts to determine this constant, or rather inconstant, have from time to time been recorded, nearly all experimentors agreeing directly or by inference that Rankine's theory of conjugate pressures is correct.

Prof. Ira O. Baker, in his "Masonry Construction," and referring to the stability of retaining walls concludes that "to determine the effect of the thrust of a bank of earth against a wall, it is necessary to know (1) the amount of the pressure, (2) its point of application, and (3) its line of action. The

determination of these three quantities requires three equations. The resistance of the wall to sliding and to overturning can be found with sufficient accuracy, but the other elements of the problem are, in the present state of our knowledge indeterminate,'' and he frankly suggests that since something must be assumed, it is more simple and direct to assume the thickness of the wall at once than to derive the latter from equations based upon a number of uncertain assumptions.

Whether engineers favor the overworked principle of least resistance or prefer Rankine's more rational hypothesis, it is a safe assumption that there has never been or ever will be any satisfactory solution mathematically determining the ratio between vertical and lateral pressures against extended surfaces, although the problem in the future as in the past offers a fruitful subject for academic discussion; but the argument will continue around the circle, since the character of the elements and factors are indeterminate and variable; the hard-baked and stratified earth of today, exerting practically no horizontal thrust, may under the changed conditions of tomorrow become a slush, with pressure due to static and liquid head, or a material under normal conditions offering at one time no horizontal pressure by simple and natural change may produce the maximum thrust or pressure.

While admitting the impossibility of establishing any theoretical rule for these determinations, as engineers and practical men we are constantly called upon to meet actual conditions, and if we are denied scientific knowledge and deductions we must consult the records of others, especially their failures; these danger signals, if heeded, leading to our own salvation.

Breakage in Sewer Conduits.

In an instructive paper read by Mr. Alexander Potter before the Boston Society of Civil Engineers, October, 1905, and referring to the failure of pipe sewers in the Orange, New Jersey, works, and of which Mr. Potter was chief engineer, is the following:

From examination of constructed lines of pipe sewers it is almost certain that if a pipe line ruptures at all it will do so at the time of the first heavy rain storm after the trench has been completely backfilled, provided the frost is out of the ground when the rain occurs. . . . On 26,303 feet of 24-inch diameter pipe, most of which was standard thickness, 24 different breaks occurred, aggregating 1,500 feet, each break running from 15 feet to 150 feet. Nearly all of the breaks occurred either in gravel or rock cuttings. No breaks were found in quicksand. . . . The depths of cuts where breaks occurred varied from 6 feet to 20 feet, but more broken pipes were found at the lesser depths. . . . The cracks occurred usually on four quarters of the pipe, with a preponderance of top and bottom cracks. The ends of the cracks on one pipe would be coincident with the beginning of the cracks in the next pipe. . . . My impression is that probably 85 per cent of the pipes were broken by strain transmitted from defective conditions in the other 15 per cent.

The salient features from these excerpts are:

(1) Observed failure after rain storms.

(2) Failures limited to rock trenches.

(3) Shallow depths where failures occurred.

(4) Phenomenon of failure by quartering.

(5) Transmission of rupturing stress from joint to joint.

Considering these items in reversed order, 5, 4 and 3 are conditions generally found, in the writer's experience, to prevail; but in his own work, failure was not limited to rock trenches, but, to the contrary, most generally occurred in trenches of quicksand and unstable sub-foundations, as was referred to in the Tampa experience before alluded to; although in the damage case mentioned, a considerable portion of the pipe had failed in rock cuts, and, in the writer's opinion, the failure of pipe under such conditions may be attributed to the shock or tremor caused by blasting even a considerable distance in advance of pipe laying, the susceptability of the vitrified pipe to this being well known, and in this connection the following, if not substantiative, is at least suggestive:

A year or more ago the Jefferson County Sewerage Commission, Mr. Julian Kendrick, chief engineer, had completed a section of their work near Birmingham, Alabama, when there occurred an explosion of a magazine containing dyna-

mite, and about a quarter of a mile from the work, following which an examination of several thousand feet of 24-inch vitrified pipe sewer revealed the fact that it had been shattered to an extent making it necessary to entirely relay. Without following this incident further, but returning to item 1, *i. e.*: "Observed failure after rainstorms," the writer's own experience closely follows that of Mr. Potter's and an hypothesis accounting for this phenomenon injects another element into the problem, since failure may have occurred after a rain of such slight fall and duration as to preclude the reasonable conjecture that it might be the product of saturation and additional weight.

Admitting that earth pressures are indeterminate, within certain limitations it is definitely established that the stresses are not directly proportionate to the height of the covering in sewer trenches, since this undoubtedly reacts upon the sides, producing an arching effect, tending toward self-support, acting with beam effect; increasing with the square of the height of the superincumbent earth, directly affected by the cohesion and tenacity of the mass particles. In the case of clean, dry sand or of the same material at point of saturation, the effect is negative, but under normal conditions a part of the load is supported by the arching action of the material, producing the paradoxical result that greater pressures are sometimes exerted in shallow trenches than in certain others with considerably greater depth of filling.

These natural laws are well understood and it is also known that the tendency to self support through cohesion is noticably affected by tremor or shock, and as well that the tenacity of the particles is quickly destroyed by moisture; hence it is the writer's belief that even a light rainfall, penetrating the longitudinal crevices caused by shrinkage of the replaced earth from the original trench walls, may be sufficient to break down and destroy any lateral thrust exerted by the filling, and which had supported in whole or in part the load over the pipe, and through the loss of the cohesion principle there may occur a

sudden application of the load, producing pressures due to a weight twice that of one gradually applied; again, the breaking away or the melting of the particles may produce an impact or dynamic action through small space, but sufficient to cause disastrous shock, one or both of these principles may account for the phenomena.

But concerning the effect of earth pressures, their direction and intensity, when all is said, we must admit that the present state of our knowledge leaves much to be desired, and having made this concession, we will proceed to a consideration of the section and materials generally used for sewer conduits.

In sewer systems, for mains, submains and laterals, although there has been some deviation from the circular or cylindrical form (the manufacturers of England and continental Europe listing "stone-ware" sections of ovoidal pattern), there would seem to be little disposition to depart from the practice of some 5,000 B. C., when the prehistoric architects and builders of Babylonial temples used baked clay pipes, of short circular sections, for their drainage and waste.

The standard of the present time in the United States is the familiar cylindrical pipe, of the bell and spigot pattern, from 2 to 3 feet in length and from 4 to 36 inches in diameter.

These pipes are all composed of clays of different grades, ground to a proper consistency, tempered and forced through dies when in plastic condition under heavy pressure. After being dried and smoothed, cut, straightened and otherwise finished, pipe of decreasing diameters are "stuffed" or telescoped one within the other, and arranged in kilns under heat sufficient to fuse or vitrify the clay, after which a salt-glaze is produced upon the external surfaces to render the material more impervious.

In nature clays of a proper consistency are seldom found, and the best pipe are the product of careful mixtures, including both "shale" and "fire clay."

In chemical composition these clays contain alumina, silica, lime, magnesia, oxide of iron, soda and water in combination.

Those rich in alumina, the alkalies being mostly absent, are most refractory, and while capable of sustaining high continued heat, the finished product is of open or porous texture, these are the so-called fire clay products.

The shales have a greater alkalinity, with greater tendency toward fusing or vitrification, and while dense, hard and cohesive, are glass like and brittle in substance, hence the necessity of a combination of these two natural materials. Unfortunately the tendency seems to be away from the use of the fire clays, greater strength being secured at the expense of a less frangible, if somewhat more porous product, and a keener commercial competition seeming to account for this tendency, since the shales are generally mined at a less expense than are the fire clays. In tests made upon samples both of imported Scotch and domestic pipe, Mr. Julius Adams, then city engineer for Brooklyn, noted that the shale pipe or "stone pottery ware" "although extremely hard, is lacking in the element of toughness, hence is inferior for our purpose to the imported pipe, or to the pipes made after the same method."

Sixty years' experience does not seem to have effected the truth of this criticism.

Physical tests upon clays used in the production of sewer pipes are conspicuously lacking, although experiments have been made upon homogeneous materials, manufactured into paving brick and fire brick, by the national and private testing laboratories.

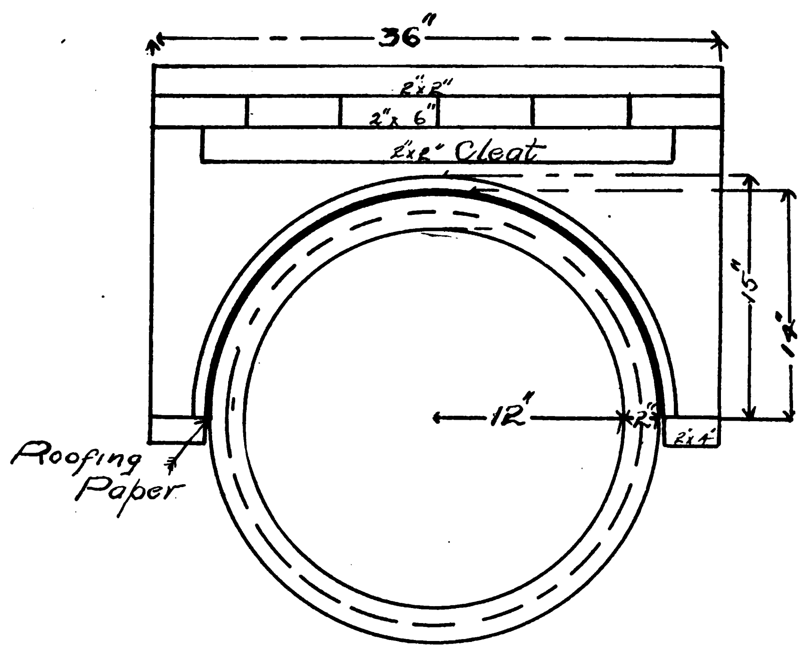
The average of such tests at the government Watertown Arsenal, gives 1,300 pounds as the modulous of rupture, while from tests made by the writer upon sewer pipe material vitrified, R was found to be 1,368 pounds.

This constant varies naturally with the different clays and degrees of heat to which it has been subjected, but in attempting to use this factor for the solution of practical problems, we are confronted with the fact that so far as the writer is aware, no satisfactory hypothesis has been established promising rational results.

If we analyze the stresses for a 24-inch diameter sewer pipe, with shell of 2 inches, and consider the load as uniformly distributed upon a beam with span equal to the diameter, the bending moments at the axes will be equal and found to be $M = 1/16\ W\ d$, where W is the total load and d is the diameter of the pipe. Representing the fill in feet by h; the weight per cubic foot of earth as w; f, the maximum fiber stress in bending, and t, the thickness of the pipe walls, with d, as its internal diameter, from the beam formula we have approximately

$$h = \frac{4\ ft^2}{d^2} \qquad (1)$$

Solving for a pipe of 24 inches diameter, 2 inches thick, with maximum fiber stress assumed as 1,300, and the weight of a cubic foot of earth as 100 pounds, we find that $h = 36.1$ feet as the extreme load tending to produce rupture.

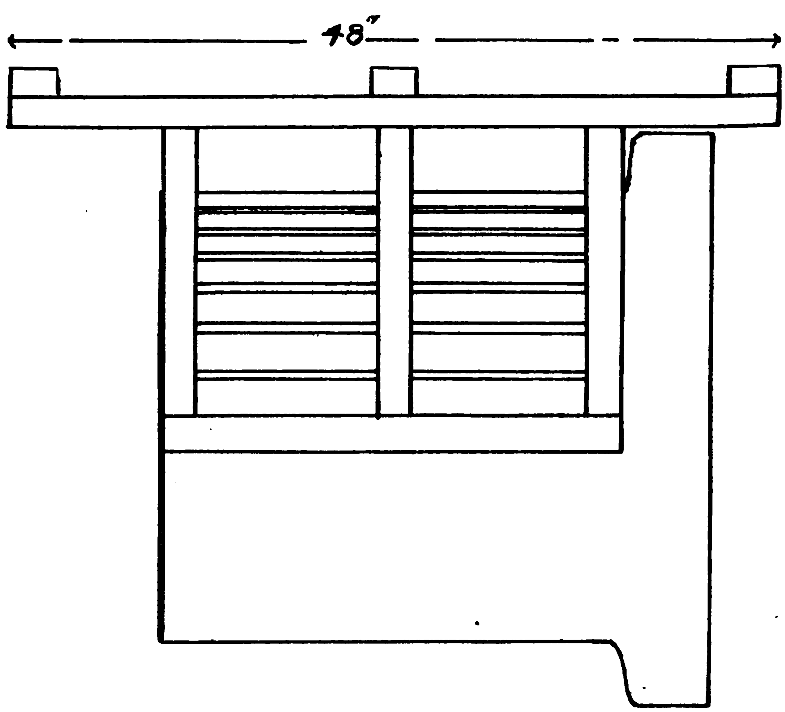


METHOD OF TESTING 24-INCH SEWER PIPES, END VIEW.

Considering these stresses as applied to a ring instead of to a beam, and assuming with Rankine that "the thrust round a circular ring under an uniform normal pressure is the product of the pressure on an unit of circumference by the radius," we have the equation

$$T = p\,r \tag{2}$$

For comparison, and using the same conditions as assumed for the beam, with h = 36.1, multiplied by the weight w, = 100 pounds, the unit of pressure p, = 25, into the radius r, = 12 inches, produces a thrust T, = 300 pounds. Since the modulous of resistance is 1,300 pounds, the circular section is some four times stronger than the same material used as a beam, and, by analysis, the thrust on the ring varies as the diameter of the pipe.



METHOD OF TESTING 24-INCH SEWER PIPE, SIDE VIEW.

Figured as a ring and using a factor of safety of 5, the safe load for a 24-inch pipe is found to be 31.2 feet.

Sewer pipe when jointed and laid in continuous lines are certainly neither beams nor rings; but only tentative methods, considering the continuous cylinder, have been advanced by writers on structural mechanics; but, as has been admitted, the intensity and direction of the forces tending to rupture are indeterminate, and while it has been proven that the circular arch is mechanically the best shape to resist any uniform normal pressure from without, under conditions of sewer loading the forces are unbalanced in amount and direction; therefore, if practicable, some form of the familiar elipse of stress, modified to suit different conditions, might solve the problem, and the true section might be of eliptical form, as with arched bridges or like structures; finally the whole matter, for the writer at least, is clouded with doubt, and he turns with satisfaction again to the actual and practical.

THE FLATTENING OF PIPE.

In an article in the *Engineering News*, December, 1904, Mr. Walter Patch gave a detailed account of the flattening of large cast iron pipe under earth pressure, and reported a number of of such pipe 48 inches in diameter and 1¼-inch shell, had been broken longitudinally in certain work under his control, while other lengths had been flattened out of round under 22 feet of earth fill, a diagram being submitted, showing the horizontal diameters to be 4.043 feet, while the vertical were only 3.979 feet.

Following this in the same periodical a few months later appeared a communication from Mr. William P. Snow, M. Am. Soc. C. E., giving his experience with a line of 20-inch vitrified pipe, in a trench only 6 feet deep. After completion, in a length of 300 feet, 30 joints were found to have failed longitudinally at the top, bottom and each side:

> The drain was thus made up of four curved pieces or slabs laid together, forming an eliptic area. At the top and bottom the cracks opened about 3-32 inch on the interior of the pipe, and the side cracks had opened a like amount on the exterior, so the vertical diameter had

diminished, while the horizontal diameter had increased proportionately. . . . It is very probable that if this Akron pipe had possessed the same elasticity that the cast iron pipe had, it would have taken the eliptical form without cracking, and have been practically as good as when first laid.

Participating in this discussion, the writer contributed the following to the *Engineering News*, January, 1905:

The fact that the compressive strength of sewer pipe material is far greater than any pressure that is likely to come upon it makes its rupture apparently inexplicable. It is the common notion that nearly all experiments have been made with the idea that the pipe breaks as a beam. The fact is, the pipe breaks as a cylindrical ring, and not as a cylindrical beam. It never breaks across but always splits lengthwise. The rupture is not necessarily the result of appreciable movement—there may be none. The movement, if any, may be incidental only and produced by the force or load which ruptures. The rupture is not compression, as so many imagine, but by tension. It does not crush; it is broken apart. This explains why pipe sewers of the larger sizes have not been absolute failures. They split, but are not seriously displaced, so are still operative as conduits under better conditions of load. They will stand much greater pressure in the sectional state than when whole, because they are practically hinged in the line of rupture; as a hinged arch will sustain more than a solid one of equal dimensions.

When displacement follows rupture, as it may when the sides can spread, the pipe collapses, the pieces become slabs, the pipe being found broken lengthwise, generally in four sections. If there is any cross-breaking, it occurs with the pieces and after the initial rupture has taken place.

It is only with the smaller sizes that cross-breaking under a load is possible. To make the sizes of such thickness that they will not rupture is impracticable. Now, acting as a cylindrical ring under opposite pressures, the rupture will occur where the bending moment is greatest, that is, at the top and bottom of the pipe. The bending moments at these points are equal. The pipe will break at the top and at the bottom, accompanied with ruptures at the sides, forming four slabs. The prevention is to so tamp the earth that the lower half of the pipe is firmly held in place.

In this case the upper half acts as an arch, and is much stronger.

The pipe will break even under these conditions with bad filling, but always into lengthwise pieces, never a cylindrical beam. When it ruptures as an arch, the lines of rupture will be scarcely half way down from the top to the sides. The bottom half will show like lines, or it may show but one line. When the rupture occurs as an arch it will collapse, and may

collapse when it breaks as a ring if the load be so great that the edges shear, but in the great majority of cases the pipe may still serve as a conduit.

It is unquestionably a fact that if careful investigation were made of pipe sewers of the larger sizes, an enormous amount of pipe would be found cracked, and it is only when pipe is so badly broken as to collapse, that official attention is given and repairs insisted upon.

If the theory advanced by the writer is true and the cracked pipe operate under a better condition of load, upon the hypothesis that the hinged arch will support a greater load than a solid one, there is no real reason for the replacement of such pipe, unless they are laid in saturated soil and the leakage results in a largely decreased sewage capacity.

Few authentic tests of sewer oı culvert pipe have been made, although rival manufacturers can generally be relied upon to furnish results favorable to their own product. During the year 1896, at the Watertown Arsenal, the government made tests of two samples each of pipe from 12 inches to 30 inches in diameter, furnished by the Portland Stoneware Company, of Portland, Me. Referring to these tests, in a recent letter to the writer, the manufacturers say in part: "We manufacture our pipe from a low grade fire clay and use no shale whatever. Our material vitrifies well, and, from tests, is found to be as strong or stronger than other makes."

These pipes were tested between hard wood cushions fitted to the diameter of the pipe and covering approximately one-third of the exterior, and compressed in a hydraulic machine. The figures as consolidated by the writer are as follows:

U. S. Government Test at Watertown Arsenal.

30 inch pipe	Walls, inches 2.30	Ult. Strength	8,250 pounds.
30	2.30		8,890
24	2.00		7,120
24	2.00		7,310
20	1.70		7,880
20	1.70		6,020
18	1.62		9,180
18	1.61		10,010
15	1.46		7,980
15	....		7,250
12	1.37		8,160

Such pipe are known to the trade as "double-strength," being proportionally thicker in stock and inferentially stronger than those designated as "standard," containing, however, only from 8 to 10 per cent more material than the latter. Both classes are made by the same process, and if is questionable whether a proportionately stronger pipe is produced thereby, since in the thicker pipe a core of underdone clay is sometimes found, showing at times distinct laminations, hence it is uncertain whether the greater thickness and consequent cost represents real values.

Pipe Requirements and Inspection.

While no recognized standard for vitrified pipes prevails in this country, the Eastern and Western manufacturers having adopted different lists, the requirements for pipe making and permissible defects follow a certain general practice, modified by the individual experience of the maker or engineer, broadly, all pipe must be well vitrified, salt-glazed; must be of homogeneous texture, and of the bell and spigot pattern, with thickness generally specified and lengths from 2 to 3 feet. Variations of about three per cent in diameter, and one-four inch from the straight line are generally permitted.

Defects caused by transportation and fire cracks, blisters and other surface irregularities are determined as injurious or the contrary directly by the engineer on inspection, such authority being usually insisted upon and conceded.

Concerning breakage in transit, extracts from several letters from some of the best known manufacturers upon this point are as follows:

> The damage in transit depends very much upon the length of the haul and a very great deal upon the manner in which the railroads handle a car. Assuming that 500 miles is an average haul and a car properly handled, we would say that one-half of one per cent of the number of pieces would be the normal breakage; that is, one would expect a car containing 1,000 pieces of 6-inch pipe to have 50 pieces broken, or a car containing 200 pieces of 15-inch pipe, that 10 pieces would be broken. . . . We usually figure two per cent of our list prices for breakage on

pipe in transit. The same percentage is figured on all sizes of pipe, as we cannot say that any particular size is subject to more breakage than other sizes.

Other rejections upon the line of the work depend largely upon the personal equation of the engineer or inspector, but it is very certain that if the strict letter of the specifications is insisted upon, very few manufacturers would be able to fill an average order without an enormous amount of waste . As a general rule, rejections for all causes may amount to from 10 to 25 per cent without being considered excessive.

Pipe Jointing.

The evolution of the separate systems of sewers is the product of the advance in sanitary science during the past 30 years, prior to which clay pipes were used principally for drainage, including culvert outlets, and for these purposes the admission of ground water was given little consideration, if not regarded as a positive advantage. Under such construction, and where a jointing material was used, its imperfect application did not impair the strength of the drain, and each piece of pipe might with perfect propriety rest upon its own bearing independently of the next length.

With the introduction of the sanitary sewer, with reduced area, with necessity for limiting the infiltration and preventing the leakage of sewage, as Mr. Alexander Potter has pointed out, in the sanitary system the proper jointing of a pipe line introduces an element of weakness through the lack of elasticity of the usual jointing material, as it may, and frequently does vitally affect the stability of the entire line.

Recent excavations of prehistoric ruins discovered drainage and waste pipes joined together with bitumen, forming undisturbed, permanent and inpervious connections after the lapse of ages.

In latter days joints of clay pipe drains were made of pipe clay in plastic state, but at the present time mortar consisting

of cement and sand of varying proportions represents the general practice for jointing material.

The quantities required for this purpose, calculated by the writer and published in the *Engineering News* of February, 1905, are as follows:

FOR EACH 100 FEET OF SEWER.

			1 cement: 1 sand			1 cement: 2 sand.		
Diameter inches.	L'gth feet.	Mortar C. Y.	Cement barrels.	Sand C. Y.	Ft. laid to bbl. Cement.	Cement barrels.	Sand C. Y.	Ft. laid to bbl. cement.
6-in.	2½	0.003	0.01248	0.00201	803	0.00855	0.00252	1168
8-in.	2½	0.038	0.15808	0.02546	633	0.10830	0.03192	923
10-in.	2½	0.058	0.24128	0.03886	410	0.16530	0.04872	605
12-in.	2½	0.089	0.37024	0.05963	270	0.25365	0.07476	394
15-in.	2½	0.123	0.51268	0.08241	195	0.35055	0.10332	285
18-in.	2½	0.167	0.69472	0.11189	144	0.47595	0.14018	210
20-in.	2½	0.237	0.98592	0.15879	101	0.67545	0.19908	148
24-in.	2½	0.299	1.24384	0.20033	80	0.85215	0.25116	117
27-in.	3.0	0.492	2.04672	0.32964	49	1.40220	0.41328	71
30-in.	3.0	0.548	2.27968	0.36716	44	1.56180	0.46032	64
36-in.	3.0	0.849	3.53184	0.56883	29	2.41965	0.71316	41

In an effort to improve upon the standard cement joint, other materials have been tried. Joints are reported by Mr. Kenneth Allen, M. Am. Soc. C. E., for sewer construction at Atlantic City, N. J., consisting of a combination of raw pine tar and Rosendale cement, in proportions of 25 gallons of tar, estimated to cost $2.00 to each barrel of cement used. For this jointing, hemp gaskets were caulked into the annular space and the composition, as paste, was pressed by hand into the spaces and beveled off on the outside.

Mr. Alexander Potter, in the New Jersey combined system, first used the sand and sulphur mixture, for which he claimed most satisfactory results. Flour of sulphur mixed with sand was heated in gasoline furnaces to 230 degrees Fahrenheit, and when of the proper consistency was poured by ladle into hemp caulked joints, the material setting very quickly and requiring no caulking. Test briquettes of this composition gave tensile strength of from 400 to 700 pounds, with laboratory tests of .017 of one per cent absorption, Mr. Potter assuming that under actual conditions from 10 to 100 per cent of ground water was excluded. The cost of this joint, estimated by Mr. Potter, is tabulated below:

SAND-SULPHUR JOINTS.

Size, inches.	Amount of mixture, pounds.	Cost of joints, cents each.	Cost per foot. 3 ft. lengths.	2½ ft. lengths.
24	10.0	.295	.10	.12
22	9.0	.282	.095	.11
20	8.0	.260	.09	.10
18	7.0	.247	.08	.09

With this material the rigidity of the joint had a corresponding advantage, since it was possible to connect two or three lengths of pipe on the surface, but on account of its rigidity, for pipe of larger sizes it was thought desirable to deposit from 2 to 3 cubic feet of concrete under the pipe haunches.

A recent attempt abroad to secure an impervious and non-rigid pipe joint has met with success according to advices recently received by the writer from Messrs. Fairbank & Son, civil engineers, York, England, in connection with their installation of sewerage and disposal works near York. This is a patented process known as "Rubite," a composition manufactured from special kinds of bitumen and rock asphalt, but is used with a socketless pipe, the claim being that it is absolutely water tight, permanent, adhesive, unaffected by acids or gases, and non-rigid.

Messrs. Fairbank & Son write in this connection, "from our practical experience of the joint, we should have no hesitation either in recommending its use, or in using it in our practice, in situations where bad ground and water occurs, or in dry situations where it is desired to make a really first class job. In very bad ground we were able to joint three sets of three pipes together on blocks, afterwards carefully lowering the nine pipe on to the bed of the trench, and then making one actual joint in the trench."

These joints on unsocketed pipes are made by pouring the mixture from a heating furnace by a ladle into moulds clamped about the pipe ends, and could probably not be used with our own bell and spigot pipe, since it cools and solidifies so quickly that the joint could not be "run" or "poured."

Perviousness of Sewers.

Much has been written upon the perviousness of sewers, and in this connection in an article for the *Engineering News,* August, 1905, the writer took occasion to discuss the infiltration of ground water into sewer systems, giving the result of tests made by him on sections of 8-inch sewer pipes connected with cement mortar joints, and afterwards immersed under 7 feet head of water, showing upon examination the infiltration of 145 cubic inches, equivalent to 1,329 U. S. gallons per mile of sewer having 2½ feet lengths. In this paper numerous examples of the observed leakage of sewer systems were cited, the following being a single instance:

> The City of Malden, Mass., with a population of 34,000, has 45.45 miles of sanitary sewers. Records kept by the city engineer show that the leakage upon completion of 38 miles of the system was 50,000 gallons per mile of sewer, 60 per cent of the work being in saturated soil. The drainage area covered by these sewers was 1,461 acres, of which 450 acres embraced a territory in which sewers were laid from one to six feet below the permanent ground water line. The rainfall for the year immediately preceding the guaging was 42.5 inches, or about 123,000 gallons per mile of sewer. The population per mile of sewer is 770, and the total leakage amounted to about 40 per cent of the annual rainfall over the area sewered, or about 70 gallons per capita. Underdrains were used in construction, and jointing was done with neat portland cement, 75 barrels being used per mile of 8-inch pipe in wet work and 63 barrels in dry trenches.

A liberal allowance for house sewage is from 75 to 80 gallons per capita, hence to provide for such conditions as actually existed at Malden, the design would have included capacities twice as great as would have been necessary had the calculations provided only for the legitimate requirements. While this is an unusual case, allowance for 26,000 gallons of ground water per mile of sewer is made for the 900 miles of sanitary sewers now being constructed in New Orleans, La.; and when it is considered that after the entire works are built, the enormous amount of 23,400,000 gallons per day will have to be disposed of by pumping, the necessity of a proper jointing is readily apparent.

In the calculations for the joint trunk sewer of New Jersey, its chief engineer designed for an infiltration of 33 per cent for 145 miles of mains and latterals, and while concrete was used to some extent in wet trenches to reduce the leakage, Mr. Potter reports, "This did not stop all leakage, but the actual amount of leakage on the entire system was less than 15 per cent of the capacity. Had concrete been generally used and the same care given in jointing the pipe, the leakage could have been reduced fully 50 per cent. The value of the additional capacity of the system thus secured for sewage purposes would have been $148,170."

Some idea of the cost of removing and relaying sewer pipe under exceptionally difficult conditions may be gained from the following items reported as work done on an abandoned contract by the sewer department of one of our large cities:

Cost of removing and replacing 30 feet of 24-inch sewer, cut 12.7 feet:

Labor	$219 25
Pipe	48 00
Cement	28 14
Sand	11 81
Gravel	28 00
Lumber	16 00
Total	$351 20

The above shows an average cost of $11.71 per foot, while the price bid was $6.65 for the same work.

This contract was abandoned by the contractor after having executed nearly one-half million dollars of work, final inspection showing that quantities of the larger sized pipe sewers had failed, the greater proportion through settlement of foundations, the joints generally pulling apart, although many sections were found crushed or broken in the usual manner.

This testimony is authentic and when reduced to figures and as applied to the larger systems, the results are startling and obtain to a lesser degree in all work of this class; the conclusion being irresistable that an imperative necessity exists for better practice both in the matter of joint requirements

and for specifications governing the use of sewer pipes of the larger diameters.

On account of susceptibility to shock rather than the limiting depth of filling, the practice of using clay culvert pipe, once so common, has largely been abandoned by the railway companies of this country, the tendency being toward cast iron pipes for this service, and from the same objection, these in turn have been generally discarded for concrete construction of varying types.

For the purpose of comparison, the following tabulation is submitted:

	——Estimated Cost per Foot Laid——			
Diameter, inches.	Stand. vit. incased.	D. S. vit pipe.	Short sec. concrete.	Two ring brick.
18	..95	.85		
20	1.25	1.20		
24	1.65	1.20	1.75	2.60
27	2.15	2.05	2.25	3.45
30	2.60	2.60	3.00	3.06
33	3.50	3.50	3.50	3.32
36	4.25	4.30	4.00	3.50

With the usual co-efficient of friction, it is readily demonstrated that the glazed clay pipes deliver greater fluid volumes than either brick or concrete sewers, possessing the further advantage of eliminating skilled labor, except in jointing, but the disadvantages have been fully set forth in this article, and certainly merit serious consideration

The writer is of the firm belief that under normal conditions the use of unprotected vitrified clay pipes should be limited to and including 15-inch diameters; that beyond and including 24-inch, standard sewer pipe incased in a lean concrete up to its spring line and then beveled off at 45 degrees, is good construction; that reinforced concrete pipe of 27, 30 and 33 inches can be economically manufactured, preferably on the line of the works, and should be used, while 36-inch and larger sizes should be of brick or continuous concrete construction, depending upon soil, labor, available materials and other limiting conditions.

With the smaller sizes of vitrified sewer pipe far greater attention should be given toward securing an impervious connection, with experimental effort toward an elastic, permanent and non-rigid joint composition, with full understanding that the more careful work, while necessarily augmenting the cost, in the final analysis would permit safe estimating while the elimination of the element of ground water to be provided for would more than compensate for increased unit prices.

In conclusion, having contributed his mite to the general fund, the writer will feel more than compensated for his efforts in pointing out undeniable weakness in current practice if attention leads to improved methods, or if the recitation of his own experience and deductions therefrom shall have in part dispelled some of the mystery and doubt surrounding the phenomena of the crushing of sewer conduits.

FINAL DISPOSITION OF GARBAGE AND RUBBISH.

By Frederick P. Smith.

There is possibly no feature of municipal administration in the majority of communities so capable of improvement in many respects as the method of disposing of the miscellaneous wastes which are produced daily.

Such wastes are commonly classed as "garbage" and consist of refuse from food or food supplies; of rubbish of all sorts; of offal from abattoirs and markets; of dead animals; and in some communities, of manure and night soil. In all communities it is a recognized principle of sanitation that garbage, dead animals, offal and other putrefactive wastes, capable of creating a nuisance by odors of decay, or a menace to health because of the pathogenic germs they breed, shall be gathered up with more or less care and destroyed with more or less thoroughness.

But in comparatively few communities is there the public spirit or civic pride or even a general demand for cleanliness of back yards, cellars, stables, alleys and streets sufficient to provide the means to secure a clean city.

There is in every community a certain proportion of the population who are clean by instinct or breeding and they keep their premises free from refuse at no matter what expense or trouble. There are many others not so well able to spend much time or money on anything other than the essentials of life who would be clean if they easily could. And there are others who violate all laws of sanitation and hygiene just because of their lazy and ignorant way of doing things.

It is the purpose of this paper to briefly outline possible improvements of a practical nature in this branch of sanitary work. To this end attention is called to the usual classification of the materials to be disposed of:

FIRST: *Garbage,* as usually defined in health ordinances, consisting of all forms of refuse from food or food supplies, decayed vegetables or fruit and offal from markets, together with dead animals, or other putrefactive wastes.

SECOND: *Rubbish,* by which is meant non-putrefactive wastes, such as old paper, rags, bottles, tin cans, old crockery, bedding, shoes, rubbers, boxes, barrels, packing materials, etc.

THIRD: *Manure.* This form of waste is one too often overlooked by sanitary officers, and is allowed to accumulate for months at a stretch without removal. Sanitarians look upon the manure heap as the principal breeding place of the common house fly which is charged with and proven guilty of being the bearer of many common diseases.

FOURTH: *Night Soil.* Nothing is so difficult to dispose of in a cleanly, hygienic manner as the contents of privy vaults and cesspools, in those communities not fully supplied with sewer facilities.

Methods of Disposal.

All forms of refuse may be disposed of by burial in such a manner that no harm may come from them if a suitable site for such a method can be secured within a reasonable distance of a town, where the nearby wells and water courses may not be injuriously affected thereby. Such localities are few and the suburban extensions due to electric railways are rapidly closing the dumping ground of many a community which is now compelled to seek a more modern method.

Disposal may be accomplished by dumping at sea or in lakes or rivers provided the federal government, or suits for damages, or common sense do not prevent. Fortunately, all these factors are rapidly shutting off the system of disposal by water carriage.

A community may dispose of its wastes in a cleanly and sanitary manner by the proper and intelligent use of either of the several systems described below:

Disposal by Burning at high temperature in suitable furnaces.

The furnaces in which the burning is successfully accomplished are designed especially for the purpose and are known as "Crematories," "Incinerators," or "Destructors," the designation depending somewhat upon their design but more upon the fancy of their designers.

To the extent that there is any distinction in the nearly synonymous titles applied to refuse burning furnaces, it may be said that a *Crematory* is one which burns with free combustion and comparatively low temperatures under the natural draft of a rather tall chimney.

An *Incinerator* carries on the work of destruction of organic matter by burning at high temperatures under restricted combustion with natural draft to produce a coking of the mass.

A *Destructor* is a refuse burning furnace usually operated by forced draft in which the attempt is not merely to reduce to a cinder or ash, but to fuse to a clinker.

A good design of furnace, however, under whatever name it may operate, will smell as sweet.

The system of disposal by burning is the only one to be considered by small communities because the expense of installation, operation and maintenance of the other systems is out of proportion to the quantities of refuse to be disposed of.

Rate of Production of Refuse.

In this connection it is well to consider the average quantities of refuse created per capita. It is unnecessary to call attention to the considerable variation in quantity or composition of the refuse of communities as governed by their climatic and geographical conditions, as well as by the general characteristics of the community. The refuse of the northern cities runs strongly in greases, ashes and garbage, while in southern cities the refuse is strong in decayed fruits, packing materials and night soil.

It is safe to say that a community of average prosperity will produce about a ton of garbage to each 4,000 of population

per day. In addition to this there is produced an equal or greater weight of rubbish.

Manure may run as high as a ton to each 5,000 of population, although, like the number of dead animals and the quantity of night soil, it is very variable.

Roughly speaking, a refuse disposal plant should be large enough to care for a ton of mixed garbage, refuse and other wastes to each thousand of population.

The system of *disposal by burning* cares for all forms of the rubbish of a community.

Disposal by Utilization.

Many who are aware of the value of the materials which go to make up the aggregate of the daily refuse of a community, look upon their destruction by fire as wasteful and extravagant.

Waste papers, paper boxes, etc., have a value of from $4.00 to $12.00 per ton in some cities when assorted and baled.

Old clothing, bedding, rags, rubbers, bottles, tin cans, all have values which are very well worth considering when they are properly separated.

The greases and oils in garbage represent many good dollars when they are extracted and purified.

Disregarding the value of reclaimed materials in their natural state, some are attracted by their calorific or fuel values.

These utilization systems are thus naturally divided into groups or classes according to their purpose or design.

Steam Utilization: Refuse may be burned in a furnace in such a manner as to generate steam in a boiler which may be connected therewith. When a community considers the combination of steam generation with refuse disposal, it should carefully determine several important factors as compared with simple disposal by burning.

First: The need or utility of the steam when generated. Is there any useful purpose for which steam is desired by a community reasonably near the site to be used for the disposal system?

Second: Is the volume of steam capable of being generated for practical use by burning the refuse, sufficient to warrant the great increase in the cost of the installation, the operation and the depreciation of the necessary plant over that involved in disposal by the simpler methods?

Given a population of fifty thousand or more which owns and operates a pumping plant, in connection with its municipal water works or sewer systems, and we may find it desirable to construct a plant for the utilization of the heat from refuse, but hardly otherwise.

Municipal committees which see only the value of the power without counting the cost of getting it are simply chasing rainbows.

Without attempting the precision which would involve the careful analysis of the average refuse of each community, it may be broadly stated that the fuel value of the refuse is from one-sixth to one-tenth that of fair steaming coal.

Thus fifty tons of refuse has in it the heat which the burning of from five (5) to eight (8) tons of coal would generate. The gross value of the heat from the fifty tons of refuse is therefore from $15.00 to $30.00 per day according to the cost of coal.

Now the simple practical question to determine is the cost of getting out the value, without incurring an expense for the plant, the operation and the depreciation which will offset the saving.

In large cities of 150,000 population or more a utilization plant which provides for the salvage of all valuable materials and the generation of enough steam from the burning of the worthless rubbish to operate the machinery of the plant is feasible, practicable and may be profitable.

Disposal by Reduction.

This system treats only the *garbage* and in all contracts for its use all refuse other than garbage is rejected and *must be separately collected.*

In the extra cost of separate collections, some communities have realized after starting a garbage reduction plant that they had not fully comprehended the whole problem. The householder has found serious inconvenience due to the necessity of separating his garbage from the rest of his refuse. It has meant two or three refuse cans about the place where there was only one before. Reduction plants have about them the characteristic odors of rendering works, soap factories, etc., and for this reason are always located at such a distance from the center of population as to greatly increase the cost of garbage collection.

The writer believes it to be a fact that in any city large enough to support a garbage reduction plant, the saving to be effected in the cost of collection and disposal by the use of three or more conveniently located burning systems will more than offset the salvage values of the refuse.

Disposal by Reduction is usually done by private contractors at a large annual expense to the city. The writer is not aware of any municipally owned reduction plant.

While it may be true that the contract may be profitable to the operating company, it is doubtful if it is the best method to serve the city's interests.

Approximate Cost of the Several Systems.

As a guide to the cost of disposal plants, exclusive of the cost of the site, but inclusive of the necessary enclosing building with approaches and the chimney, the following list is given. It is subject to wide variations, however, according to the class of building and chimney construction:

Crematories or Incinerators of a capacity of 15 to 20 tons per day, \$4,000 to \$10,000.

Of a capacity to 25 to 40 tons per day, $6,000 to $18,000.
Of a capacity of 50 to 80 tons per day, $10,000 to $30,000.
Of a capacity of 100 to 150 tons per day, $25,000 to $40,000.
Destructors, using forced draft:
Of a capacity of 40 to 60 tons per day, $18,000 to $35,000.
Of a capacity of 80 to 100 tons per day, $30,000 to $45,000.
Of a capacity of 125 to 175 tons per day, $50,000 to $80,000.

Utilization systems vary so greatly that no approximate estimate would be of service.

Reduction Systems usually cost two or three times as much as the burning systems.

MR. HOWARD: I was disappointed in the ending of that paper. The author does not seem to know of any municipal reduction plants and I think there are a great many scattered over the country.

MR. FOLWELL: There is, I believe, one such plant, and only one— that at Cleveland, O. This has been operated for over two years as a municipal plant, and the reports concerning it have been given considerable publicity. It is reported to be very successful.

THE CARE AND MAINTENANCE OF PARKS.

By James Owen.

The three main functions of park development and maintenance are, first, hygienic; second, educational, and third, aesthetic.

While the order as given may be properly criticised, yet in our daily life the body is or should be our first consideration as the mind is trained according to its physical capacity; so it is proposed in these remarks to discuss the whole question on that basis and that alone.

It is undoubtedly true that the popular endorsement of the park movement—for in this country it is a popular movement—in a large sense, is due to the innate aesthetical idea of the public desiring relief from the conjestion and close surroundings of city life; yet on the completion of any park improvement in any community the larger use is by the younger people in whom the aesthetic tendency is hardly developed.

To complete the classification parks are of three different characters, viz., open spaces in large cities, of small size; large areas in the cities that have appropriate park development, and outlying tracts of extended size, but of limited treatment, preserving the original rural characteristics. The three functions and the three characters of development are fairly in accord, and the recognition of this accord should be the governing impulse in all park development. It may be assumed, therefore, that recognizing the hygienic function as paramount, the small open spots or parks scattered throughout the area of any large city are or should be practically playgrounds as well as resting places, and the treatment, in their construction, should be based on that idea, varying, of course, with the character of the population and their habits.

The elaboration of small park work with carefully graded walks and lawns, with ample foliage and fences around the lawns, limiting its use by the people to walking and sitting, may be appropriate in certain conditions, but generally an open area with free scope for children to race around is surely the more popular idea of development.

In the development of the larger park area more scope can be given to systematic development of a higher order, and the aesthetic development be paramount. To that end, therefore, the public mind, with inherent craving for the open air and for unlimited roaming, can now be controlled into desirable limits and every taste and sense be gratified.

The largest development of park construction in the country is based on these lines and generally the practice is fairly well defined, subject only to modification of details according special requirements.

In a cursory glance at this practice the ideas have been developed as follows: Drives, walks and lawns, with water areas, form the first basis of construction, and these should be laid out according to topography of the land and the general trend of travel. A great many mistakes have been made in park construction in laying out winding roads and meandering walks that have no finality or object. A person starting does not know where he goes or where he will get to. This may be desirable for the diletanti or the hobo, but it is not appreciated by the American public who are always desirous of getting there, wherever "there" may be. Many parks lose a large part of their usefulness for such a reason. The ideal way is first to create an object. This object may be a lake, a bandstand, a monument or a restaurant, the distance to the object being immaterial; then let the walk or drive be the thoroughfare to it. Straight lines need not, in fact, should not be adhered to in such walks or drives. A little section of a drive here and a cluster of walks there may be ideal from an aesthetic point of view, but the rule should be that a definite object should exist as the termination of all such thoroughfares. The

ball ground will attract more people than any other object. Let the access to this be as direct as is consistent with a proper alignment. One thought occurs here, and that is that the actions and movements of millions of people are controlled and governed by the layout of all park development, and this movement extends to futurity, therefore it is paramount to consider the probable desires and emotions of the people in all such layout. Another problem, also emotional, is to be faced, namely, the desire for short cuts. Such a desire has a tendency to concentrate travel on lawns instead of fostering the scattering idea, but probably such a difficulty can be finally eliminated in the maintenance.

Given the drives, walks, lawns and lakes, the further development can be purely a matter of taste; and that we enter into the aesthetic development, which, of course, is limitless, governed only by the ideas of the constructor and the money there is to spend. Of course the playground, the gymnasium and the picnic section are to be considered, but all these now can be treated as part of the park and true park development can be maintained.

The flower garden, conservatories, nurseries and zoological section can now be located; and then will come the planting and location of trees and shrubs, and with the fulfillment of these items a park is now created. Of course in many localities these amplifications are not desired, and the money is not forthcoming for them. In many others various other desirable objects of interest and instruction have been created and always with satisfaction to the community.

The creation of a park is incidental, but the maintenance is permanent and the maintenance problem is largely left to untrained hands and is not always in control of master minds after the creative mind has left and gone. It may be stated as an axiom that the maintenance of any park is a subject deserving more consideration and watchfulness than its creation. The public mind, after the interest in such creation has lapsed, is apt to become indifferent; those in control not feeling

the stimulus of public watchfulness may become negligent and what was originally a thing of beauty may without proper care and solicitation become an eyesore and really a menace. To prevent such an occurrence it is desirable now to allude to the aesthetic and educational part of a park system and what the possibilities are in that direction.

To the thinking mind no greater object lesson can be given to the average city dweller, with sordid and untidy surroundings, than the tidiness and carefulness exhibited in the maintenance of public grounds. If the older generation have not the training or time, the younger folk imperceptibly absorb these notions, and in good time, in the maintenance of their own homes, the influence will be felt. So let the cardinal maxim of all park maintenance be TIDINESS. This word is used purposely as it conveys the idea more fittingly. Of course in a purely rural park, where nature is left to its own devices, the word tidiness is there only relative, as nature itself is always tidy, but in small city parks and in the larger areas a complete force should always be maintained to enforce the idea.

Incident to tidiness is the maintenance of roads, walks and lawns and keeping them in proper repair. These repairs must be continuous and incessant, or otherwise an appearance of neglect will ensue, and if delayed, extra cost will be the consequence. The maintenance of lawns is always a problem, now that the idea of segregation has been abandoned and the public at large allowed to roam at will. The tendency to concentration must if possible be obviated, and if the population is not too great in proportion to the area of the lawns no permanent harm is occasioned. Resodding or reseeding, however, is found necessary where the travel or walks lapse over on the grass. If the travel, however, is greater than the grass can stand, the section affected must be closed off.

In all park systems there has to be, in original construction, a system of drainage on the surface and underground. This drainage is always a matter of solicitude in maintenance owing to obstruction and sometimes lack of size of the pipe. In the

newer construction and development the underground drainage is wisely being eliminated as far as is practicable. This is better, provided the surface water is not allowed to tear up the roads or sod. In rainy weather a park is not much used, so surface water is of little inconvenience.

One of the great problems in park maintenance is the proper renewal of the water in the ponds and lakes. The gathering of surface water into a pond and letting it stay there until the next rain washes some of it out, is a practice not to be tolerated. It is a detriment to health, and very often unsightly to the eye. If renewal can be obtained from a spring it is satisfactory, otherwise an artificial supply should be provided or the pond abandoned, as has been done in certain cases.

A water surface in a park is always a pleasing feature to the eye, but it is somewhat undesirable from a hygienic point of view, and furthermore all surface water, with the washing of streets and roads and lawns, should be gathered and delivered into its natural drainage courses and got rid of. Where wading pools are used pure water is absolutely necessary, and should either be delivered from a spring or from the regular city supply. In the case of flower gardens, nurseries, conservatories and zoological departments, they, of course, should have special experts in charge to achieve good results; but there is one point that is often neglected in parks, and that is the proper means of identification of all specimens, whether trees, flowers, animals or birds, by means of labels or tags, so that all interested parties may know their names. This is necessary for educational purposes. As to the trees and shrubs, the usual rule has been in original construction to plant a great many more than will finally be desired, with the idea of thinning out the undesirable ones as the years go by, or allow for the trees dying off. It is questionable, however, whether such a practice is desirable or proper. Many of the parks in our country today have too small open areas and too many trees. They did not die as expected, and the maintenance department has hesitated to thin them out, and in many instances the draft on the

soil is too great and the trees themselves are becoming so restricted in their growth that none of them will arrive at complete maturity. The better practice of today is to plant more sparingly, giving each tree a better scope for growth, extend the open areas and instead of cultivating the old fashioned grouping idea let there be isolated trees of large growth with vistas between. Sunlight and shade are component parts of park development, but the open sunlight should prevail. Sunlight is necessary to man, the shade is a luxury and relief. The same idea of planting should prevail in the matter of shrubs. The removal of these is, of course, easy if the growth is luxuriant, and their shape is not so apt to be deformed by closeness, as with the larger trees. In the matter of inserting choice shrubbery in public parks much difference of opinion prevails, as in some localities it is claimed that the expensive and rare varieties are liable to be stolen, but the ordinary specimens are unmolested. In considering this point it may be asserted that when a community is educated so highly as to appreciate the rare varieties they are well on the road to be educated up to the point that it is better to have them left in their proper place than to be illegally appropriated. Aestheticism when cultivated always is accompanied with an appreciation of good ethics. That is to say, the original cause of the trouble will be its own cure; so therefore let it be strongly maintained that the greater the variety of foliage, either in trees or shrubs, the better of course the pictorial effect and the better the educational effect. The novelty of a specimen may at first attract the desire of possession, but the possession illegally must invariably be accompanied in a mind so constituted with regrets at the improper conduct.

Another question of maintenance that requires special treatment and consideration is the athletic end; the surface of a playground, the care of the gymnasium plant, the removal of the sod on a well played ball ground, the mowing of the grass and care of trees on the golf links are all matters that are imperative as being in the hygienic department. The athletic

development of the city youth, instead of being in the corner lot as of old, is now fostered in the parks, and the result of this change is the education of the rising generation both mentally and physically to a higher plane. Of a sequence the popularity of a park system is dependent on the strict care with which the athletic department is maintained. No special preference should be given to any game; all should be perfectly provided for, whether used by a barefoot boy on the ball ground, or the elaborately togged golf player on the links. In twenty years no one knows who will be on the top, but they will both look back to their boyhood games with pleasure and gratification.

At this point it might be proper to allude to the treatment of the larger rural parks, or reservations as they are sometimes called. The maintenance of such territories of course cannot be so complete or perfect as of parks proper. In Europe these parks are of ancient creation and during the process of years their development has sometimes merged into that of a mural park. Such a disposition is not appropriate for designs in this country. Nature is here to have full sway lightly guided by the hand of man. Drives or roads must be constructed and walks laid out and kept in good traveling condition, but the growth of the trees should be regulated by judicious forestry, the cultivation of the open ground should be ideal, farming and game preserves can be established with little original cost and small outlay in maintenance.

A combination of the mural and rural development was effected originally in Central Park, New York, the upper end being reserved for the rural idea. The growth of the city overruled the attempt and subsequently rural parks were acquired in the annexed district. The national government has of later years approved of the idea and large tracts in the far west have been segregated to public use for ever. Some of them, like the Yosemite Valley, have an elaborate system of maintenance; others are merely in a formative condition.

The policeing of public parks is a matter of grave consideration. The line between liberty and license is hard to draw.

The good judgment of a park policeman is a component part of his character. Order must, of course, be maintained, and such order can only be construed as the largest license to the individual without detriment to the community. The newer parks have the hardest time to maintain the desired equilibrium. In the course of years, however, tradition is developed and the general public, imperceptibly to themselves, acquiesce in the order of rules and very little friction or trouble ensues. The theft of shrubs or plants is a crime and should be considered as such, but generally a howl on the ball grounds is tolerated in the park, even if the cynic growls in his solitude. The regulation of the use of the gymnasium plants, the wading pools, the speed of autos, bicycles and carriages are all matters of judgment and no strict rules can be given except a limit in all cases, and limit of speed, a limit of the use of the wading pools and of the monopoly of the swings must be defined by the police or his superiors; but whatever rules are formulated, impartial enforcement must be maintained or trouble will ensue.

In the rural parks protection must be afforded to all visitors and in the dense forest the lone girl must feel a sense of protection or the value of her trip will be lost. It may be stated, however, that there is less crime, less hoodlumism in the public parks than in any other place of free resort, and to the thinking mind this is due to the uplifting influence of the surroundings.

There is one view of park development and maintenance that requires special consideration and one part of it has so far not yet been taken hold of, and that is the educational feature. A city bred boy, especially in a large city, receives his education in nature and allied studies from his books, with but little opportunity to see the real thing. A complete park development affords to the student a variety of object lessons that he will absorb in a much quicker time than mere book knowledge will give it. Think of the subjects embraced in a complete park. The study of botany, including flowers, plants and trees. Forestry, properly developed in the rural por-

tion. Animals in the zoological department, birds, fishes in the ponds and lakes, weather from the meterological apparatus used in all well maintained parks can also be profitably studied in a limited degree. Now with all these subjects, which are really part of the curriculum of the public school, why not let the park system be an adjunct of the school? Why not let classes in turn visit the parks under competent teachers and learn from actual inspection?

The parks of the country are great educational influences, to a large extent indirectly and imperceptibly, in fact, by absorption. Let this influence be extended into a practical shape, and much good will result. A boy or girl goes to the park for the fun of it. The man or woman for rest or recreation. All are benefited, and that brings this article to the last item for consideration, viz., the question of transportation.

This is a subject that is greatly neglected in all park development; however highly developed a park may be, and however attractive, it is of little use unless easily accessible. This accessibility should really be made a part of the original lay out. Many parks have been originally built in the outlying limits of a growing city. The city has slowly built up to the park, perhaps beyond it. Trolley or steam car accommodations may be there or not. It is some one else's business to care for that. During these years the amount of patronage that a park so situated enjoys it limited to a much less number than is desirable or proper.

An ideal park lay out ought to have public communication through it, not by stage or hack at 25 cents per hour, but for the generally accepted nickel. This can be done by constructing a trolley road in the park itself, hidden from sight if possible, but certainly with no level crossing on a drive or walk. The sunken roads in Central Park, New York, show what can be done; nobody sees them and very few know of their existence, but what a boon to the tired mother and children would be a trolley to take them to the desired spot instead of tramping half a mile or a mile in the hot sun. This idea will be

severely criticised by the conservative element of the community, but to the thinking mind the great drawback today in the use of the large park in the cities of this country is lack of transportation. The autos don't want it. The men can walk, the boys can run, but the children and their mothers want relief.

This article was not intended as a treatise on park development, the intention being merely to allude to certain principles and ideas which are not generally perceived, and if public interest be aroused to their consideration, these words will not have been in vain.

REPORT OF THE COMMITTEE ON CITY GOVERNMENT AND LEGISLATION.

Chairman, Horace Andrews, Albany, N. Y.

A brief review of former reports of the Committee on City Government and Legislation will be of interest to the Society.

The first report, at the third annual convention, October, 1896, was by Mr. C. C. Brown, and treats of the public works departments, the methods of selection of heads and of the conduct of public works. This report is chiefly based upon the experience of Indianapolis, St. Louis, Milwaukee, Omaha and Cleveland, and concludes by making suggestions regarding the term of mayor, composition of board of public works, the carrying on of public works and as to franchises.

At this third meeting Mr. John L. Kennedy, of Nashville, Tenn., read a paper on "Municipal Government," relating particularly to the methods in use in Nashville.

At the Fourth convention Mr. C. C. Brown presented a second paper on "Methods of Appointment of Boards of Public Works and Engineers and Checks Upon Their Action," confining his observations to cities of from 5,000 to 200,000 population.

No report was made at the fifth convention, though that of the Committee on Taxation and Assessment relates to questions of city government.

A preliminary report was made by Mr. F. W. Cappelen, of Minneapolis, at the sixth convention, and his full report appears in the transactions of the next convention, August, 1900.

This paper of Mr. Cappelen on "City Government," covers 132 pages of the report. It compares the fundamental laws of eight foreign countries and the charters of San Francisco, Seattle, Indianapolis, Milwaukee, New Orleans, St. Louis, Minneapolis and Greater New York. Mr. Cappelen also reviews

the National Municipal League's constitutional amendment and corporation act. At this same (seventh) convention Mr. Robert E. McMath, of St. Louis, presented a paper on "Municipal Home Rule, Its Scope and Limitations," and Mr. August Herrmann, of Cincinnati, a paper on "The Ohio Municipal Code Commission on the Subject of Finance and Taxation."

At the 1901 convention Prof. Olin H. Landreth, of Schenectady, read a short paper on "State Legislation and Municipal Sanitation."

At the ninth, tenth and eleventh conventions no papers bearing directly upon the subjects before this committee were presented. At the 1905 convention Mr. Thos. Neville, of Rochester, presented a paper on "Legislative Functions Under the White Charter and the Practical Effects of the Latter Upon Municipal Government." Mr. Neville discussed the working of the so-called uniform charter for cities in New York state of the second class, comprising at that time Rochester, Syracuse, Albany and Troy.

Mr. Milo R. Maltbie also presented a paper on "Legislative Functions of Greater New York."

At the last convention of 1906, the thirteenth, Mr. Lawson Purdy, of New York, presented a paper on "Constitutional Restraints Upon the Taxing Power," and Mr. L. H. Weissleder, of Cincinnati, a paper on "Municipal Franchises."

While the above mentioned papers are of special interest as pertaining to city government and legislation, a number of other papers contain valuable facts and suggestions regarding the government of cities.

The functions of a city government are defined and placed under three groups, as follows, by Mr. Bryce:

(a) Those which are delegated by the state out of its general coercive and administrative powers, including the police power, the granting of licenses, the execution of laws relating to adulteration and explosives;

(b) Those which, though done under general laws, are properly matters of local charge and subject to local regulation, such as education and the care of the poor; and

(c) Those which are not so much of a political as of a purely business order, such as the paving and cleaning of streets, the maintenance of proper drains, the provision of water and light. In respect of the first and to some extent of the second of these groups, the city may be properly deemed a political entity; in respect of the third it is rather to be compared to a business corporation or company, in which the taxpayers are shareholders, doing, through the agency of the city officers, things which each might do for himself, though with more cost and trouble. All three sets of functions are dealt with by American legislation in the same way, and are alike given to officials and a legislature elected by persons of whom a large part pay no direct taxes.

The objects of our society, as defined in its constitution, are "to disseminate information and experience upon, and to promote the best methods to be employed in the management of municipal departments, and in the construction of municipal works." The purely business functions of a city government, as defined under Mr. Bryce's third group, therefore, are the matters of special interest to this Society.

An examination of the increasing importance of municipalities will indicate the size of the field to be covered by the activities of this Society, even when these are confined to the business functions of government.

The following tabulation shows briefly the important facts regarding the increase of urban population in the United States:

Year.	Cities exceeding 8,000 inhabitants.	Ratio of persons living in cities exceeding 8,000 to total population.
1790...........	6	3.3 per cent.
1880...........	286	8.5 per cent.
1890...........	447	22.6 per cent.
1900...........	545	33.1 per cent.

In 1900, in Rhode Island, 8 persons out of 10 resided in cities or towns of over 8,000 inhabitants; in Massachusetts, 76 per cent; in New York, 68.5 per cent; in New Jersey, 61.2 per cent, and in Connecticut, 53.2 per cent.

The state census of 1905 shows that in New York there were 8,067,308 inhabitants, and that there were 45 cities and 8 villages of over 8,000 inhabitants with an aggregate population of 5,792,130, or 71.8 per cent of the total. Moreover there are

38 incorporated villages having populations of over 4,000, but less than 8,000, and aggregating 195,595. Almost three-fourths of the population of the State of New York are gathered in its cities and villages.

Since the year 1900 all the cities of over 50,000 population, with the exception of Buffalo and New York City, have been governed by a so-called uniform charter. How far this charter is from being strictly uniform in all these cities of the second class, has been discussed by Mr. Thomas Neville in his interesting paper presented to the Society in 1905 and already referred to.

Owing to the fact that New York state's enumeration of 1905 added the cities of Utica, Schenectady and Yonkers to the list of cities of the second class, it was found advisable to repeal the "White" uniform charter, referred to by Mr. Neville. This charter goes out of effect entirely on January 1, 1908, being replaced by a charter of somewhat similar character. Since all of New York's second class cities also have former charters, repealed only as to the sections which conflict with those of the uniform charter, it is evident that no great degree of uniformity exists in their governments.

It is an interesting question as to the advisability of attempting to bring cities of any state under a "blanket" charter. This matter has recently been agitated in Connecticut. A commission was appointed and many hearings were held in its eighteen cities; these cities had charters differing widely from one another, so much so that their comparison was a matter of extreme difficulty. However, the commission reported to the last legislature adversely as to the formulation of a uniform charter.

The citizens of any city should be familiar with their own charter. Continuous change makes this difficult, but by a study of experiences of other cities valuable improvements may be discovered and incorporated into charters of cities that appreciate the value of wise changes.

"The electors of cities should be allowed to make experiments," remarks Mr. Conkling in his instructive book on "City Government in the United States." "It is not too much to say that in some of our rapidly growing cities the government can be improved only by experimental laws. Too many mandatory laws are enacted by the legislatures. The state should authorize and empower municipal authorities generally to act in their discretion," he further adds.

Present indications are that uniformity of city charters is not being attained to any great degree, and that the attempt has resulted in making it more difficult for the ordinary citizen to become acquainted with the laws of his city. Regarding the principle of home rule in cities much has been written. Mr. McMath's paper on this subject has been referred to. The trend of opinion seems to be in favor of municipal home rule as regards the business functions now under consideration. The difficult question is to secure wise action on the part of city government. Either there must be some modification of the franchise or we must be content to await the slow process of general education of the voter.

The New York commissioners of 1876 appointed to "devise a plan for the government of cities in the State of New York," declare the "assumption by the state legislature of the direct control of local affairs" to be one of the causes of the evils apparent in municipal government. Among other remedies they suggest the very radical one of "vesting the legislative powers of municipalities in two bodies—a board of aldermen, elected by the ordinary, manhood, suffrage, to be the common council of each city; a board of finance of from 6 to 15 members, elected by voters who have for two years paid an annual tax on property assessed at not less than $500, or a rent of not less than $250. This board of finance to have a practically exclusive control of the taxation and expenditure of each city, and of the exercise of its borrowing powers and in some matters to act only by a two-thirds majority."

From an educational point of view it is to be regretted that thus far no American city has experimented with restrictions

upon the voting power as recommended by the above mentioned commissioners. Perhaps less hesitancy would exist, as to the wisdom of entrusting cities with a larger measure of home rule, if some regulation of the voter's qualifications should be in force. Mr. Cappelen remarks, "For myself, I believe that property owners should have a greater voice in municipal affairs than they now do." His valuable and instructive paper sheds much light upon the laws of foreign countries regarding restrictions upon voting power.

Naturally we are impatient at the slow process of evolution by which our laws are improved. A study of conditions of 15 or 20 years ago in our larger cities shows gratifying progress at the present time. "The problem in America has been to make a great city in a few years out of nothing," writes Mr. Seth Low, and he adds, while speaking of some of the disadvantages which our cities have labored under, that one of these has been "to provide adequately for their current needs, while discounting the future so freely in order to provide their permanent plant." "When the great American cities have paid for the permanent plant which they have been accumulating during the last half century, so that the duty which lies before them is chiefly that of caring adequately for the current life of their population, a vast improvement . . . may reasonably be expected." This society has, through its teachings as well as through the agency of many of its members, the important duties of helping to secure reasonable permanence in the plant, of seeing that the money raised by taxation is wisely expended for this enduring plant and at the same time of caring for the current life of the population.

We should not discourage experiments in municipal government. We should make it our duty to explain fully to the Society any particulars regarding our ordinances or charters that have been thoroughly successful; not being led astray by enthusiasm regarding laws of our own proposing or promoting but endeavoring to obtain the real opinion of the intelligent citizens throughout the municipality.

After all, it is the education of the entire body of citizens in regard to municipal responsibilities that will bring improvement to our city governments, and it is the aim of this Society to further such education. The writer can fitly close by again quoting from the words of Mr. James Bryce: "No one who studies the municipal history of the last decades will doubt that things are better than they were twenty-five years ago. The newer frames of government are an improvement upon the older. Rogues are less audacious. Good citizens are more active. Party spirit is still permitted to dominate and pervert municipal politics, yet the mischief it does it more clearly discerned and the number of those who resist it daily increases. In the increase of that number and the growth of a stronger sense of civic duty, rather than in any changes of mechanism, lies the ultimate hope for the reform of city governments."

REPORT OF COMMITTEE ON MUNICIPAL DATA AND STATISTICS.

By J. W. Howard, Chairman, Consulting Engineer, New York City.

This committee thinks it wise to refrain, for the moment, from presenting an array of statistics. It ventures to remind the members of this Society of certain facts and make some suggestions concerning public necessities or utilities which must be administered, constructed, maintained or operated by public or by quasi-public officers or servants of the people.

The requirements of every city, in the nature of things, compel certain necessities of the people to become and remain social and natural monopolies; whether administered directly by city officials or indirectly by persons having public franchises. The first problem is to decide what functions of a modern city are best placed directly in charge of the employees of the people in the legislative and executive branches. The second problem naturally follows and is to determine what functions of city necessities and services shall be entrusted, temporarily at least, to private administration, and under what agreements and safeguards just to the citizens and to the quasi-public although private undertakings.

The honest and efficient legislation, planning, construction, maintenance and operation of the public, social and physical necessities and utilities, depend upon the degree of character, culture, education, information and executive ability, possessed by the principal officials of cities. The failure of some of our cities to be as well administered and as well equipped as others is due largely to a lack of one or more of the elements named but needed by the managers and workers in any useful and successful enterprise, whether public or private.

If these elements of character, etc., governed the motives and guided the actions of all city officials and of the officers

of private corporations having public franchises, it would not be so difficult to determine which ones of the common municipal utilities should be placed under the direct administration of city officials and which ones under the management of private interests and under what agreements. But actual conditions of men and things must be met as they exist today and as they will exist more or less modified in the future.

The experience of modern municipal life demands that the following interests, common to all the inhabitants, are best placed under direct or indirect charge of proper municipal officers: education, health, fire, police, taxes, license, excise or control of alcohol, morals or control of entertainments or distractions which tend to debase character, libraries, legislation, law, justice, markets, water supply, sewers, pavements, street cleaning, public lighting, parks and play grounds, public baths, comfort stations, public docks, street car traffic whether on the surface, above or below ground, public statistics and other utilities.

Cities which retain in their employ city engineers and other officials of the operating departments who have shown themselves to be honest and efficient, become better equipped and at less cost than cities which change such officials at short periods for selfish reasons of politicians, or than cities where other and selfish interests interfere with the duties which city engineers and permanent employees are only too glad to perform and thereby gain a good reputation and the appreciation of the public.

The measure of success of each of the many departments of municipal life can be determined by complete and properly arranged data and statistics of each department. These statistics should include hundreds of details beside dollars, because it is not by money cost, although that is important, that the true success of municipal administration is measured.

Municipal statistics are too often kept in an obscure manner without analysis and without tables of comparison with the statistics of previous years. They should be properly analyzed

into many subdivisions or units. Final condensed tables should set forth each year not only the statistics for that year but should be compelled by law or municipal ordinance to include the condensed statistical results of at least the preceding four years. Such complete statistics not only enable an administration of a department to show what it has accomplished and indicate the results compared with previous administrations, but it is of indispensible assistance in making up proper annual budgets for each succeeding year.

Much has been said and written upon the uniformity of municipal statistics in different cities. While uniformity is important, it is far more important that statistics should be properly analyzed and complete, whether they are kept in just the same manner as other cities or not.

There is no more important a department or bureau for a city to establish than that of municipal statistics. The chief in charge of that bureau should be a man of the highest character and education possible to obtain. We need but to mention Monsieur Bertillon in charge of the municipal statistical bureau of Paris, France, to illustrate the important function which statistics perform in the past and present magnificent municipal management, equipment, maintenance and operation of that city, which in matters of public works and many other departments, is a world model.

Nothing checks wrong doing in public or private life as surely as correct data or statistics. If anyone openly or secretly opposes establishing and maintaining such records and statistics, his motives are to be suspected. Nothing will help more to solve the trying problems of our city administration than municipal statistics. They help a city avoid the mistakes and reap the benefit of its own progress and that of other cities, under a system of exchange and comparison with the records and data of other cities. The principal cities of Europe have maintained and exchanged such valuable data for many years and a few American cities have started to do the same.

We recommend that the members of this Society endeavor more and more to record and have published the statistics of their departments and we urge all municipal departments to do the same.

We recommend that every city establish a "bureau of municipal statistics" or a "municipal statistician" and prescribe the detailed records which must be kept; also how and when these services shall be performed and reports rendered for the information, guidance, assistance and benefit of living and future inhabitants.

UNIFORMITY OF BUILDING LAWS.

By Alcide Chausse, Superintendent of Buildings, Montreal.

My intention was to read a short paper on Fire Protection. but after having read Mr. Fitzpatrick's interesting paper on the same subject I found that he had covered the ground so thoroughly that the best thing for me to do was to branch out on another subject. It happens that besides being chairman of the Committee on Fire Protection of this Association, I am also Secretary of the newly formed Institute of Architects of Canada, which had its first convention in Montreal in August last, and one of the subjects that was brought out for discussion at that convention was "Uniformity in Building Laws." It was declared that at the present time there was a great lack of uniformity in building regulations in different cities, the effect of which state of affairs was apparent when an architect was accustomed no longer to look at home alone for clients. The present by-laws or ordinances were too often a jumble of regulations and makeshifts. Some cities even deem it unnecessary to think of making a standard. But the result was too obvious when fires broke out and did so much destruction to property. It was recognized that the basic idea was a uniform standard of strength, of maintenance and fire protection.

Reference was also made to the practice of many towns of entrusting the drawing up of building regulations to inexperienced persons, to members of civic corporations who were grocers, doctors and what-not in actual experience, while architects and experts were generally in the minority. There are towns which did not have one iota of regulation. That is the conditions in the United States and in Canada. The feeling is therefore growing that the governments should step in and do something to bring order out of chaos. If such a law were established by a state or a province, it would then remain for

towns and cities to supplement it as they saw fit. But some standard is needed.

It is a common argument that the poor man cannot afford to build well; that he has to use cheap materials or that the proprietor has to do so for him, in order to bring prices down to his level; but the truth is that the poor man in the end has more to pay when cheaper building is permitted. Witness the enormous losses by fire. Fire is, indeed, the great destroyer of property. American and Canadian cities have paid each year enormous sums of money to prevent fires. A fire is a sort of contagious disease to be combatted, and to be combatted successfully it should be prepared for before it actually breaks out.

Shabby, combustible buildings should be prohibited, and indestructible buildings should be erected. It is, of course, a personal matter whether a man would choose to save his own property or not. But it is not a personal matter whether a man, through neglect, should contribute to destroy the property of his neighbor. It is too much to expect that the individual would replace combustible with incombustible material in his buildings. That is a question for the state or province to regulate. It is really a question whether a man who puts up good buildings should be taxed as much as a man who does not. Would it not be preferable to establish a sliding scale of taxes, and reward the man who built a fireproof structure by taxing him less, and punish the men who kept to the old plan by taxing him more?

The architects have some responsibility in the matter. It is truly lamentable to see the little attention paid to fireproofing, and is it not true that many architects are more interested in some piece of carving than in fireproofing a building? Such a man forgets that real art is truthful and that buildings put up in any other way are nothing but whited sepulchres. An architect should always advise his client of the folly of poor construction. A good architect would do that, but there should be a general law placing the question beyond doubt.

I know that there would be some difficulty in making a standard of a matter which really had none. In some localities not even stone or brick construction could be secured. It would not be of much use to oppose wood construction altogether, as that would be impracticable.

At the conclusion of the reading, before the Institute, of papers and discussion on this matter, the following motion was adopted:

> That in view of the wide range of architectural activity, involving the erection of buildings in widely separated centres, in view of the great losses involved by conflagration of poorly constructed buildings, and in view of the danger of serious accidents, the Institute of Architects of Canada do hereby urge upon the various municipalities of the Dominion the desirability of the enactment of uniform building by-laws, which could be graded to suit the conditions and requirements of rural communities, villages, towns and cities.

It was thought that perhaps it would be advisable to go a little further and offer to aid the towns and villages by drafting regulations for the construction of good buildings.

The suggestion was accepted and it was resolved to add to the motion that the Institute of Architects of Canada would be happy to assist in the compilation of such by-laws. This suggestion was adopted.

It was also decided to send copies of this resolution to all the American and Canadian association of cities and of municipal improvements and this is what I am now doing in reading these remarks on Uniformity of Building Laws, which I believe is an important item in fire protection.

IMPROVEMENTS IN BUILDING CONSTRUCTION.

From the Point of View of Fire Protection.

By F. W. Fitzpatrick, Executive Officer, International Society of Building Inspectors.

We who have so much to do with the actual construction of cities, who have striven so hard to have that construction done well, who see the dire results of faulty construction in our daily fires, naturally fret at what we may perhaps with justice term the slow progress that is being made toward real fire prevention. Yet, think of it, in 1827 a mayor of Philadelphia was not re-elected to office because he had so far forgotten himself and tampered with private rights to the extent of having suggested to a citizen that the latter *ought* to cover a proposed building with a tin roof rather than with shingle! And was not New York the first city to insist that in a very restricted district nothing but stone or brick should be used for enclosing walls, and that less than fifty years ago? Indeed, compared with other reforms, those in the construction of buildings have been more drastic and rapid than the average. Today we have 216 cities in the United States that have established "fire limits," within which inferior construction is not tolerated; 340 cities and towns that have at least a semblance of a building ordinance regulating all construction within their limits, and 125 cities that make it compulsory to build anything over a certain number of stories in height of absolutely "fireproof construction." True, this last term is variously interpreted and so much latitude is permitted that "fireproof" is oftentimes a misnomer. Nevertheless the tendency, the intention, is there apparent and the way to true progress open.

It has not been without rebuffs and sore disappointments that what has been accomplished was done. But that is the history of everything that has been worth while. For instance,

not so very many years ago smallpox was all too common in some sections of our country and yellow fever was an accepted visitation, a regularly expected affair in others. Valuable lives, much time and money was spent in attempting to handle these epidemics at the more or less frequent intervals at which they were expected and occurred. Then a few progressive men realized that "cure" was an ineffectual, impossible attainment and that in "prevention" laid the true root of a successful coping with the ill. Vaccination, enforced cleanliness and such wise precautions against the spread of the disease, or harboring the germs, were inaugurated, but were deemed hardships and a cruel assailment of private rights by the people. Riots ensued and adverse legislation demanded and often obtained that seriously impeded the wheels of progress. But persistence and intelligence won the day and we are as free from those old-time "visitations" as the most enthusiastic of us would have ever even prayed for.

So with the construction of buildings. When men were told that they could not build just exactly to suit their ideas of convenience and economy, when they were forced to take some precautions against fire, there was a great outcry and it has been only by exceedingly great persistence that we have been enabled to obtain the point that has been reached in fire prevention. Cities and individuals are ever ready to appropriate large sums for any of the what have been termed "curative agencies," water, fire departments, etc., but when it comes to regulating the construction of buildings so that fire departments and water are made less necessary for their protection, ah, that is another matter. Heaven and earth are disturbed in an attempt to head off any such legislation, such wise precaution, because people have the old-fashioned and exploded notion that safe building is expensive. Just by way of illustration of the real economy of prevention, witness San Francisco, for instance, a fire that incidentally utterly wiped $300,000,000 of property out of existence. In not one of the big so-called skyscrapers was there any fire originated. The

damage was done by external fire gaining access to the structures via unprotected doors and windows and roofs. Wherever window and door openings were protected at all adequately, particularly with wire glass, there fire found no ingress to the protected parts. Now in those few tall buildings that successfully stood the test, in so far as their essentially structural parts are concerned, there was $13,000,000 of damage done by the fire. Had the one provision been made, the one preventative feature adopted, of using wire glass in the windows of those buildings, they at least would have been immune in so far as their contents and fittings were concerned. To so glaze those windows would have required an additional initial expense of barely $60,000. That $60,000 was "saved," but see the result.. Surely $13,000,000 of loss must more than counterbalance the $60,000 of gain! It would seem that the most indifferent scholar would see and appreciate that.

Let us assume then that it is conceded that correct building—one of the essentials of which is its indestructibility and incombustibility—is a national necessity, a national economy, a national duty. Further, it may not be stretching a point to set down that it is not only a man's duty as a citizen, one feeling a proper responsibility for the good of the whole, to build rightly, but it is also his duty to himself, as a curator of property and the protector of lives entrusted to his care. And further still, it is to his best pecuniary interests to so build, to his immediate and ultimate profit and to the protection of his investment. That, it seems to us, requires no argument to establish. But it may not be amiss for us to study the subject a little more in detail and give some attention to the consideration of what really is safe and correct building.

This is made all the more essential by the fact that the average man cannot be expected to discriminate in detail in matters about which, necessarily, even his general information must be exceedingly limited. Take, for instance, the matter of "fireproof construction"; so many things are foisted upon the unsuspecting as "fireproof," that it is not to be wondered at if

people grow skeptical as to there being anything that *is* fireproof. We hear of "fireproof wood," of "slow burning" this, that and the other thing, "fireproof" paint, etc., etc. Plausible exploiters beset the unwary at every step and the word "fireproof" is glibly pronounced and with extreme unction used as a qualifying adjective of a thousand things and systems in construction that have no more real claim to it than have the varnished paper and bamboo houses of China and Japan, e'en though these may be under the especial patronage and protection of the great god Heiyo!

Reduced to plainest terms there is nothing mysterious or overly wonderful about fireproof construction. Be it remembered first and foremost that a building that is merely of non-combustible materials is not necessarily fireproof; that a building that is of fireproof materials, which, however, are not assembled in proper form or of fireproof design, is not fireproof; a building that is not of fireproof construction and design, except in part, is not fireproof; a building that is strictly, thoroughly fireproof, may, if filled with combustible contents, have a destructive fire in it, but the building itself will not be wrecked or destroyed to an appreciable extent; a building properly designed and of strictly fireproof materials assures that only a small part of the contents can be destroyed by fire. The first great principle of fireproof construction, the materials and design being correct, is isolation. If real estate were cheaper and the property available, the greatest protection to contents would be to have a number of one-story fireproof buildings erected for their storage. That being manifestly out of the question, the next thing to do is to make each story of a tall building as separated and isolated as if it were an independent structure. This object can be attained by absolutely closing off all stairways, elevator shafts and other vertical openings. Access should be had to these by self-closing doors at every landing. It may be a trifle unhandy perhaps to be obliged to open a door every time you go from story to story, but the advantages are a hundred thousand fold and as greatly out-

weigh that one little inconvenience. These vertical openings closed, the entire contents of any one story can be burned without the people in the upper or lower stories even knowing that there is a fire. Now then, carry that principle farther; if it is a good thing to cut off each story from its fellows, then, by the same token, is it wise policy to make the story into as many units as possible. Therefore wherever you can have a partition, do so, and make its communicating openings incombustible and there you have the story again subdivided into small units. In any one of these the contents may burn up without affecting the rest of the story or the other stories. Do that and you have solved the insurance problem as well as you have acquired the science of fireproof construction. It is hardly possible that spontaneous combustion or other causes originate fire simultaneously in many units of space, though it is quite natural to expect fire to result by accident in some one unit of space sometime or another or frequently even. Therefore, in insuring contents of buildings, always provided that the building is amply protected from external attack, "conflagration risk," and the possibility of fire being reduced to some one unit of space, it is necessary only to take out a policy in a sum equivalent to the value of the contents of the greatest one unit of space in that building. That should surely appeal to the business man.

After our great conflagrations and even individual fires it has been quite plain to the average observant man that however little damage was done to the so-called fireproof buildings affected, their contents were almost always totally wiped out of existence. The fact of his occupancy of the so-called fireproof building has not seemed to mean much to the tenant. True, his occupancy of such a building has reduced the chances of a fire, but when it has occurred he certainly came out at the small end of the horn. The trouble has been that the science of fireproofing was not thoroughly understood and applied. Merely the structural portions of a building, its skeleton and main divisions, were made fireproof. All else was not

even incombustible. Small intelligence had been used in "designing" a building in a fireproof way. The result has been that the tenants' property has never been fully protected and a serious conflagration can affect the building itself to a damage of from 30 to 80 per cent of its cost value. People are beginning to see this and the owner of real estate who wishes to improve his property must go farther in the art of fireproof construction and build his building so that the lives and property of his tenants are safe-guarded equally as carefully as is his investment in the structure itself. It can be done.

Let us divest the science of technicalities and put it in terms that will clearly show its essential features and make them readily appreciable to laymen. For instance, we have all seen that granite, marble, sand or limestone, or concrete, or imitation stone facings disintegrate very rapidly under the effects of great heat. So why expose one's self to such considerable loss by using those materials for the outer facing of buildings where they are at all exposed to possible fire, on narrow streets or near adjacent highly combustible buildings? Ordinary good sense would dictate that well-burned brick and terra cotta, that have already passed through intense heat in their manufacture, are least damaged by fire; therefore it takes no wonderful amount of reasoning to induce one in his decision to use an undamageable material as against the very damageable ones, though granite and stone have for ages been looked upon as the most enduring of materials.

All the way through, the same reasoning and the same application of mere common sense are what will lead one to the selection of materials and their combination in position to constitute a really fireproof building.

You have all seen iron and steel after it has been exposed to fire, how it is twisted and warped out of all semblance to its former shape; therefore no sane man would leave metal work of any kind where it supports any structural portion, unprotected from fire. The entire skeleton of a building should be steel, steel columns and steel beams, but all this steel work

should be thoroughly coated with cement to protect it from rust and then fully and completely enclosed in brick or hollow tile fireproofing protection. The filling or floor construction and partitions should likewise be of brick or hollow tile. The latter is the most economical, well made and easiest handled material for fireproofing. There may be cases where reinforced concrete construction may be deemed particularly desirable or expedient. It is a system of construction that is fraught with difficulties; collapses and fatal accidents constantly mark its progress and I can conceive of but few situations in which it is desirable. The great claim made by its exploiters is that it is cheap. It can only be "cheap" when it is cheaply done, of cheap materials and with cheap labor and that very cheapness is what makes it so collapsible, so disastrous. But even admitting that there may be occasions for its use, the highest authorities, some of whom formerly claimed all sorts of "fireproof" and other virtues for it, now concede that it is not fireproof and that wherever it is used, it, just like steel, ought to be protected from fire by tile, brick or other suitable fire protection.

Hundreds of people, notably in San Francisco and Baltimore, spent considerable money in attempting to make "fireproof" buildings that were damaged even as much as 90 per cent of their value by the fires that occurred in those two cities. It was either a case of ignorance on the part of the architect, or the owners stopped a little short of the correct thing and began economizing at the wrong point. In most of those buildings it would have been impossible to get up a fire of any great magnitude internally. They were assailed by and succumbed to external attack. Seventy-three per cent of all the damage done by fire to buildings, other than that in which it originates, is via the window route; or more than 48 per cent of the entire fire loss of the country is traceable to the lack of window protection. Certainly a matter of some comment. Therefore, wherever there is the slightest danger of external fire, on narrow alleys and from adjoining combustible

risks, make your windows of metal sash and wire glass. Keep out the fire. Nearly all of San Francisco's awful loss was caused by fires communicating from one building to another through the windows, and we know of cases where fire actually jumped across spaces a hundred and more feet in width. So that there are few windows that can be called exempt from danger. Better still, make all your windows fire barriers.

If correct building is a little more expensive than shoddy construction, then save on the interior finish. There is where the greatest extravagance as well as the greatest combustibility runs riot. The idea of wooden floors, heavy wooden wainscoting, beamed ceilings and all that sort of nonsense in a fireproof building is an outrage to common sense. There is no need of using wood. Plastic decorations are handsomer and infinitely cheaper. Doors and trim should be of metal or other incombustible material. If marble is prohibitive in cost for wainscoting and floors, then use plain cement and plaster. If you feel that you *have to* use wood, then, for Heaven's sake, use just as little of it as you possibly can. The one sane and safe decoration is color. Turn an artist loose in your building and he will make it infinitely more attractive than the marble man or the hardwood mill man. No form of decoration costs less, is so satisfying, effective, furnishing to a degree (you know yourself that the warmly tinted walls of a sitting room more than half furnish that room, as it is so often said) and is so readily changed at will.

There are a host of details to be observed in the construction of any building, but the layman may almost rest satisfied if he but masters these essential, basic principles of construction. Their incorporation in any structure that he controls means the absolute safety of the building itself, the absolute immunity to life in that building and the very greatest amount possible of protection to the property it may contain. And after all it is but the application of good, ordinary common sense.

Nevertheless and notwithstanding, and however simple the science may be, it is "up to" the individual owner to insist

upon these principles being carried out in his building, for, unfortunately, every architect is not endowed with that degree of common sense that will prompt him to so construct a building unless he be specially and unequivocably "instructed" to do so. Some architects never get over the desire to lay on beautiful stone carvings and fixings, regardless of their adaptability, their cost or their lack of longevity. They will sacrifice everything to that one hobby. If it becomes a question between some stone carving and the fireproofing of the building, the fireproofing will have to be cut out every time. Another architect just glories in beautiful mantle pieces and elaborate wood finish, regardless of the expense and inflammability of the materials; and then others don't know, or forget, how to build properly, their one idea is what passes as "beauty" in design and they forget that no building can possibly be beautiful unless it fully expresses the purpose for which it was built and as fully asserts and proves that it is well built.

To build well, that's the point! There should be absolute co-operation on the part of the municipality, of the individual owner and of his architect. And after all the task is not so difficult and the results and benefits that accrue from its proper performance are immeasurable and far reaching. Good citizenship, self-interest, everything demands that we do it so. The main qualification necessary to the thorough understanding and application of good construction is good sense. They say that we Americans are brimful of good sense. We give many evidences of its possession; let us show it in our municipalities; and how better can it be evidenced than in the buildings we erect in those municipalities?

HISTORY OF DETROIT.

Address by Prof. A. H. Griffith.

Mr. President, Ladies and Gentlemen: I have been asked to talk to you tonight on the subject of the City of Detroit. I am very glad to do it because Detroit is a hobby with me. It ought to be with every Detroiter. I would train the newsboys on the street corners to know every foot of ground in Detroit, so that if a man came along with a satchel and asked a question, they could quickly tell him "you pass over mile after mile of the most interesting material."

It is not generally known, even by our own people, that Detroit has changed its flag five times. It has been French, English, French again, American, English, and American again; and while I have some very dear friends from across the river who pay me the compliment to come here many times during the winter, I hope that it will always remain under the American flag. (Applause.) And I believe that some of those people over there would be glad to have it remain in the same way.

Where this museum stands was the home of General Brady. A tablet on the front of the museum marks it. General Brady was a man who won fame in Pennsylvania. He was a man who fought under the stars and stripes and his name is well known to all military men. It was here that General Scott came while he was commander of the fort here, and frequently played with the children of General Brady and the Grandchildren of General Brady in the lot where this auditorium now stands. General Grant lived straight through on Fort street. It was the house that he occupied while he was the commander at Fort Wayne. So that it is historic ground all about here. Then that is not all. Some years ago I sat with a museum man at Plymouth, Mass. We sat up on

Cole Hill and looked down at Plymouth Rock, and he said to me, "You have knocked around the world a little bit, and here is the beginning of all of this country." I said, "My dear sir, you forgot that I came from Detroit." "Why, what about Detroit?" "Detroit was ten years old when the Pilgrims landed." Now that sounds like a fish story, but if you will read history you will learn that Jamestown, Va., was settled in 1606, Quebec in 1608, and there was the river and lake beckoning to those hardy old Frenchmen, "Come on, come on"; not a trackless road through the woods, but a waterway; and they came on. Tradition, pretty well founded, indicates that the French fishermen came to Detroit in 1610, and landed over near where the Michigan Central railway station is. There they found the Indians had erected stone gods, their manitou, their great god, and were worshipping them. They were French Catholics, full of the ardor of their religion, and they tore down these old idols, broke them up and scattered them along the river bank. Up until that time Belle Isle, that we look upon with so much pride, was looked upon as mere mashebee (the Indian name for swamp), because it lay in the water. The Indians gathered up the fragments of stone which the white Frenchmen had broken up, gathered them up carefully and took them in boats to Belle Isle; and there they asked their god, their god manitou, to turn them into snakes, that they might guard the island from the white men; and for years Belle Isle was known as Snake Island. Then the French got hold of Belle Isle and they wished to do away with the snakes, and they put on that island a lot of hogs, and it was called Hog Island (Isle Cochon). It was Hog Island then, and it did not become Belle Isle until 1848 when a picnic party, celebrating the Fourth of July, from Detroit went there in boats. Belle Cass was one of that party. She was a belle, not only by name but by reputation and they named it Belle Isle. We sometimes hear it called *Belle Isle.* That is not right. It is not beautiful island; it is plain Anglo-Saxon Belle Isle, named after a girl. We do say *Grosse Isle,* because that is the

French Great Island; but we never say *Belle Isle.* It is not "beautiful island," but is named after a girl. So much for the history of the island.

I might take you up there to the Library and show you the old Indian documents—written by white men it is true, but upon which they have put their Indian totem—giving you the history of that island from the very first landing of the white men, when one of the old British generals—or major later—had to make a trip to England, and even into France, to prove his right to Belle Isle: and then the people arose in arms, claiming it was a common on which they had the right to keep their cattle, and if you will read the old records, going through the old manuscripts, you will find a long and most interesting history connected with Belle Isle.

Now the old fort began just a little way below Griswold street. It ran up to about where the Edson and Moore building is today, and then came up to what was known as St. Ann street, about Jefferon avenue; and in that enclosure was the old Detroit, *la ville de Troit,* the village of the Straits. That is the proper name of Detroit, *la ville de Troit.* It is the old French name. Now that was the original Detroit. That was where Cadillac laid out his city and claimed so many arpons each way up the river and so many arpons running back from the river. People coming to Detroit for the first time wonder at our wards always fronting on the river and running back three miles or over. It is the old shoestring farms of the Frenchmen. Every man felt that his farm must face on the river and then run back. So he had so many arpons on the river and so many arpons back, and if he had five sons and died, he left this farm to the sons divided into five parts, each one having a part on the river and going back from there. Those were the old French shoestring farms, and they are our wards today, and that is why they stretch through the city in that way.

We oftentimes have people ask us questions about the various things that have occurred in Detroit. Down about where Griswold and Jefferson avenue now is was the gateway through

which Pontiac came with his Indians with their blankets wrapped around them and their guns cut off. They came into the fort under the pretense of playing ball with the British soldiers. Old Major Gladwyn had a friend among the squaws of the Indians who came to him with a present of moccasins. While she gave him the present she whispered in his ear that Pontiac and his braves would come in the next day; so Major Gladwyn, whose residence was about where Jefferson avenue crosses Woodward avenue, had posted his soldiers so that when Pontiac and his braves came in in their blankets, he had the reveille sounded and the soldiers marched out. Pontiac realized at once that he was betrayed, so he retired gracefully out of the gate with his warriors, and they burned all of the places outside of the stockade along the King's Wharf, along the old Royal Bakery,—all of that,— and tried to set fire to the fort. That was the end of the Pontiac conspiracy.

In 1805 the five governors,—or four governors, rather, together with the one judge,—the governors and judge were sent to Detroit. On the morning before they arrived in the City of Detroit, then the Village of Detroit, a fire occurred very close to where our county building is today, possibly one hundred feet this side of it, in a stable. It swept away every house in the City of Detroit with the exception of two or three along the river bank. Those two or three houses are landmarks. Before this fire the streets were thirty feet wide; St. Ann, St. Louis, St. George and all of the various streets that were named after the Kings of France and of England, not one of them over 30 feet wide. When the governors and judge looked upon the charred remains of this village they began to think of a plan to lay out a new city in a new way, and fortunately they remembered of L'Enfant who laid out Washington City. L'Enfant was consulted and it is his plan that we are carrying out today in a way. Our city council and our citizens became very stingy some years back and blocked some of the old plans of L'Enfant. The plan was that the streets were all to radiate from the campus, from the city

hall. Our Grand Circus Park was to have been a complete circle and these streets were to have gone out in each direction. By the way, how many people are there who can tell you that the longest straight street in the United States is Michigan avenue? It runs directly to Lansing, and it is as straight as a string all the way there, for the simple reason that the men who laid it out took a pencil and put it at one point and a pencil at the other and a straight edge between. It is the longest straight street in the United States—of course it is a country road part of the way, but the time will come when it will all be built up. Now they laid out the city in these broad avenues which we have today, which give us the many charming flàtiron squares which we admire.

In the old country when you travel through a town or village, it is the continual change of crooked streets that you admire, because at the end of every little way there is a building full of historic interest which attracts your attention. We have too little of it in this country. We have laid them all out in squares. Boston, possibly, is an exception, laid out after the old foot paths and cow paths of one hundred and over years ago. You know they tell the story about the stranger who went to Boston and there was a fire, just as we have had it here today, and it attracted all the people, and he, among others, and he started out to find that fire. It was night time, and he ran a certain distance and asked a policeman where the fire was, and the policeman told him up a little way, and he went a little distance and asked a policeman the way, and the policeman directed him again, and he did that three or four times, and finally the policeman told him he would run him in if he bothered him again. He was going in a circle. We don't quite do that here, but we sometimes end up against another man's building. These are the delightful things about Detroit. It does away with the sameness of one block after another.

This is Detroit of today, if its plans are carried out—and we never carry out plans. Sometimes people say to me, "You

talk so much in Detroit of what you are going to do and you do so little." Doesn't every city do that thing? It took one thousand years to build the Thames embankment in London, because the people had to wake up to it. It took two thousand years nearly to build the quays in Paris along the River Seine. You say not all that time in building. No. But people had to learn that they needed those things. When the old City of Paris began on the island of St. Louis, and they simply had a stockade around it and a bridge over to the mainland, and then when the city spread out and came down to the city island, they built another stockade, and then when it was built over to the mainland it was still other stockades, and it wasn't for one thousand years that they began to realize they must have quays, that they must build stone embankments to protect themselves from the river. Here in Detroit we expect to do that thing in one hundred years and a little over. It is true it is two hundred years since Cadillac laid out his city, and then quarreled with the Indians and returned home to die, but we talk of an esplanade along the river bank such as they have in Antwerp. It wasn't until Napoleon Bonaparte came to Antwerp in 1805 and said, "Why you have this magnificent river and your houses are built right down to the banks of the river. You don't realize its value. I will give you twenty-five million of francs if you will begin," and they began that marvelous embankment. They have bought out squares and blocks of house and torn them down. Last summer when I was in Antwerp I called on the city engineer and he showed me plans for the spending of seventy million of dollars and fifty years of work. What are you people doing in America?

You people build up one year and tear it down the next. There is nothing in that. Nobody builds for all time. If we build a board walk we would spend two hundred and fifty thousand dollars on it, and it would be thrown away. We should build one square three hundred feet and show people that it is necessary. Do like they do in Antwerp, build one block and put your stores up and invite your people down,

and there they have their beauty and their esplanade and their promenade, and they can look over the river at the magnificent shipping in every direction and they say, "We have got to have another three hundred feet," and they get it in another year, and then they say, "We will have three hundred feet more." If we would begin at Woodward avenue and build to the electric light works, we would make a start. The best way to accomplish anything in my mind is to begin. If you give a man the right of way through your yard and he uses it from his house to the street for two years, and then you tell him that he cannot have it any more, there will be a lawsuit, because he has used it and he has used it so long he feels that he owns it. Now the way to get anything is to first show the people the need of it. For ten years I talked in this museum in the front gallery. People stood on the doorway and crowded in anywhere they could, but it convinced people that we needed an auditorium and we got the auditorium. When this museum was first started it was a paying institution, 25 cents for everybody who came in. I insisted on opening the museum free on Sunday. We did. The people all came on Sunday and nobody through the week, and the result of it was that the income through the door would not pay the doorkeeper. That was all right. We did it for a year at a dead loss, and then I said, "Let's close it up," and we did. And the citizens of Detroit demanded that the museum be thrown open free all the time, and it is free. That is the way to do anything. It is the way to do anything in all these municipal matters. Take up city matters of any kind, show the people that they need it, and then you will get it.

Now we are going to beautify Detroit, not all in one year nor ten years. There are plans talked of that if they will begin on them and finish them in fifty years it will be all right. Napoleon Bonaparte began that magnificent Arch de Triumphe when he was master of the French Empire. Louis Philippe finished it when Napoleon Bonaparte had lain in his grave for twenty-one years. That is the way they accomplish things over there.

It is not done in a year, one man begins and another keeps on building. It is the only way that we will ever make a beautiful city of Detroit, more beautiful than it is today. Today we have, I believe, and it is generally conceded by every visitor to be, the most magnificent city in the United States, and naturally so. Nature has done it all, man has done nothing. We have simply taken things as we found them. This beautiful river with its magnificent sweep and curves and on which float the boats of an empire, more tonnage passing up and down the river than goes into any port in the world—and we simply admire it. We do not feel that we have had any hand in its beautifying. It is the same with Detroit. We have not wakened up. No city in the United States has wakened up. When you wake up to the possibilities many things will be done.

In Paris they tax the windows you look out of and people pay that tax because they say it pays. Last year the appropriation for the Louvre, for the picture galleries and for the public library was the only appropriation that passed the French Senate without a particle of opposition. It was the only appropriation that was made at the request of the people, and they say it paid fourfold. It was the biggest of all the appropriations. If you burn three candles in your room you pay tax on three candles, and the people pay it willingly, because a million people come into Paris every year and leave their money there and it pays. I heard a man say a short time ago way up in the east end, "I don't care anything about these conventions. I don't care anything about the crowd that comes to Detroit. I am away out here and it doesn't mean anything to me." You can't go to the Michigan Central Railway or to the Union Station and buy your breakfast and pay fifty cents for it that eventually that fifty cents does not go over the whole City of Detroit. The trouble with us Americans is that we are constantly looking for the dollars the other man lost. We go along with our noses and our eyes to the ground to see if we cannot get the dime that another man lost without working for

it. When you see that there are thousands of dollars we never put into our pockets from which we receive a benefit, then we will take pride in the city and take hold of things and do them. Taxation amounts to nothing if you get returns. A man said to me the other day, "We are paying five thousand dollars rent for our store. Ten years ago we paid eight hundred dollars, and we didn't believe we could afford to pay one thousand dollars. Today we are paying five thousand dollars and do it as easily as if it were eight hundred dollars, because we are doing the business." Whenever a city feels that they are spending money, not putting it into the pocket of the grabbers and grafters, but spending money and getting returns, it is the very best investment they can possibly make.

In 1822 the French government paid twenty-one thousand dollars for the Venus of Milo. You couldn't buy it today for a million, because if you want to see the Venus of Milo you have got to go to Paris. You can see a cast of it here and in every museum in the United States and in Europe, but if you want to see that wonderfully beautiful statue which as you go into the corridor seems to look down on you and smile, you have got to go to Paris. It pays. That monument has paid them over one hundred times. In 1871, when the Prussians marched into Paris, the committee took charge of that one statue, put it in a box, carried it to the Hotel de Ville, carried it into the cellar, walled it up, and then put a lot of valuable books in front of it, and another wall, so that if the Prussians should hunt for it they would not find it. Then the Prussians walked down the Champs Elysees, and stacked their guns on the Place de la Concorde, and then they marched out, and the Communists rising up took possession of the city. The government that should have stayed there fled to Versailles, and the whole city was in the hands of the Communists, and in one day there were eighty-six fires burning over that magnificent capital, and among them was the Hotel de Ville. And then the heart of that committee went down into their boots. They waited until the fire went out and then they put them to digging for it, and

fortunately a great water pipe had burst by the falling of heavy stones and had been pouring over this statue for days and weeks, so again Venus, as the old Greeks tell us, arose out of the waves, out of the seas, out of the water, and occupies her place today, and the Prussians did not see her. That is how they value things over there, and when we wake up to the fact that everything we can do for the city we are doing for ourselves and for the whole city, then we will make our America a glorious country. We have the wealth, we have the taste—no, not the taste. We are hardly away from log cabins and rag carpets yet, not far enough away to have all the taste that we ought to have. I wish we had stayed by rag carpets a little longer. There is a good deal more beauty in them than in the Brussels carpets we pay three or four dollars a yard for, with flowers, bigger than the top of a flour barrel and roses that never grew in heaven and earth, and you couldn't walk on them if they did, and those we buy and call it taste. We had better stayed back with our rag carpet, where every rag carries some sympathy, some kinship. It is the glory of some old mother or grandmother who has woven into each piece a part of her own life or her own heart. That is taste, a good deal better than the new things we get. But when we have cultivated through museums and libraries and the beautifying of streets—the street arabs in Paris know beautiful things. The boys take their caps off and go through the galleries and pick out the beautiful pictures and statues and they know why they are beautiful in line and color. They know those things because they are brought constantly in touch with them. We must do that in America. You can only educate by environment and circumstances, by bringing them before the people, beginning with the boy or girl. I have had one incident happen to me since I have been in this museum which I must tell you. I will tell you of one thing that pleased me more than anything I have ever known. I went up Woodward avenue last winter and found plaster casts of the things we have in the museum, only smaller in size, and there was a lot of boys

standing there, most of them street arabs and a newsboy, the dirtiest and raggedest, was telling them all about Clytie, all about how she turned to watch the sun as it rose in the east and went down in the west. He was telling the whole story, and in a reasonably good way, and I stopped to listen, and one of the boys turned around and said, "Where did you learn so much?" "Oh, up to the Art Museum," he said, "they have the same thing there only it is bigger, and it has a label on, and I read the whole label and I always remembered it." I could have hugged that boy, rags and all. And it is that, gentlemen, it is that idea of beautifying your own city and your own home that goes to make a great city. I thank you.

ADDITIONAL WRITTEN DISCUSSION OF ARTICLE "BACKFILLING TRENCHES," PAGE 59.

PAGE 59.

GEORGE C. WARREN: Since the reading of my paper on backfilling trenches, read at the October, 1907, Convention of the American Society of Municipal Improvements at Detroit, I have had occasion to notice in a city of the Middle West a very marked example of the damage done to pavements through lack of care in proper backfilling of trenches. The case referred to is on one of the principal business streets of a large city paved with asphalt with a railroad track in the center of the street, the strip of roadway between the track and curb being about 20 feet. The Water Department has had occasion in relaying water mains to excavate through several blocks on one side of the street. The soil is clay of a character which with proper care could be well tamped. The trenches were not shored with lumber and doubtless a part of the settlement of the surrounding pavement was due to this cause. The Water Department, evidently appreciating the importance of having the earth solid around and for a short distance above the pipe (in order to prevent subsequent settlement of the earth around the pipe carrying the pipe with it) pretty thoroughly tamped the earth around and for a distance of about a foot above the pipe, but above this point they threw the earth back into the trench loosely and when the backfilling was about a foot from the surface of the pavement filled the trench with water from a hydrant, and then cast earth into the water-filled trench, until the trench was full. When the free water had drained away, leaving the earth in the surface of the trench exposed, more earth was added and tamped, building up the surface of the trench about six inches above the surface of the pavement. At this stage of the operation when the backfilling was thus regarded as complete, fully one-fourth to one-third of the earth excavated from the trench was still at the side of the street. The bulk of this was hauled away, leaving a little to throw back later when subsequent settlement occurred. The result of this construction is that on a portion of the trench which had been completed less than a week at the time of my observation, the earth in the trench at places had settled six inches below the surface of the pavement and the entire pavement and concrete foundation between the trench and the track, a distance of about seven feet, had very perceptibly settled throughout the surface, in some places the pavement next to the track being as much as two inches below the rail and in some places

there being a space between the pavement and the rail as much as an inch in width. The net result is that it will cost thousands of dollars to repair the pavement, which has settled outside of the trench and as to the trench itself and the pavement to be laid over the trench, there will probably be settlement for years to come.

I am certain that municipal engineers, officials and contractors can do no better work than to use their utmost diligence in reforming the custom, which is so general as to be almost universal, of careless and improper methods in backfilling trenches both in paved and unpaved streets.

President, MORRIS R. SHERRERD

First Vice President,
JAMES OWEN

Second Vice President,
JULIAN KENDRICK

Third Vice President, FRED GIDDINGS

Secretary,
GEO. W. TILLSON

Treasurer,
L. V. CRISTY

OFFICERS FOR 1906-07

BUSINESS PROCEEDINGS

OF THE

FOURTEENTH ANNUAL CONVENTION

OF THE

American Society of Municipal Improvements.

TUESDAY, OCTOBER 1, 1907.

The Fourteenth Annual Convention of the American Society of Municipal Improvements was called to order at 3:45 P. M. by the President, M. R. Sherrerd.

THE PRESIDENT: Ladies and Gentlemen: The Chairman of the Reception Committee suggests that a good many of the members of this Society are down at the river watching the sinking of the tunnel tubes, and that Mr. Heineman, who represents the city government here, will take us all down there at this time, if we think it wise to postpone the opening exercises until tomorrow morning, and that this also would be agreeable to the local committee.

It was thereupon moved, seconded and carried that an adjournment be had until Wednesday, October 2nd, at 9:30 A. M.

WEDNESDAY, OCTOBER 2. 1907.

The session was called to order at 10:20 A. M.

THE PRESIDENT: On the program the Mayor of the City of Detroit is scheduled to welcome us, but he is absent from the city, I understand, at the unveiling of the McKinley monument at Canton, Ohio, and in his absence the President of the Common Council, Mr. David E. Heineman, will represent his honor.

MR. HEINEMAN: Mr. President and Delegates, our Guests: If all of your delegates are not here to be officially welcomed this morning, it must be for that best of all reasons, that they have of their own accord made themselves at home, and need no welcome. The best kind of welcome to a city is that kind which needs no words.

It should have been the pleasant privilege of the Mayor of the city to address this convention, but he has been absent from the city, having represented us at that shrine in Canton, Ohio, towards which in the last few days the heart of every American citizen has turned with reverence. Because of his absence, it is my pleasant privilege to meet you with a few words of welcome.

I was here yesterday afternoon, when a very small party of the convention was here, but I wish to assure you, gentlemen, that the welcome of Detroit has not become cold over night. We do not blame you for going to the river instead of continuing your session here on yesterday afternoon. It was the most remarkable sight that Detroit could have shown you, and the most remarkable sight that any city could have shown you, because, gentlemen, we are so used to seeing the railroad companies put water into their trackage, that it is worth going a long way to see them putting trackage into the water.

You are here, gentlemen, not as the delegates of many of the conventions which we as a convention city have the pleasure of entertaining—we have all kinds of conventions here, and we are glad to see all of them, but sometimes we are at a loss to find out what affinity there is between the officials who welcome them to the city and the conventions themselves. It is difficult to find anything in common except that the welcomers and the welcomees both belong to the masculine sex. But here today we have a different situation. As a city we are today the hostess of our sister cities; as officials we have the pleasure of welcoming you as fellow officials. We have some few things which we can show you, and in which we can instruct you; you have a great many in which you can instruct

us. We have a personal and selfish motive in having you here, and we have a selfish and personal motive in welcoming you and in keeping you here as long as possible. It is my privilege to be connected with organizations of this kind, and in welcoming you the words of welcome come from one who fully appreciates how much good institutions of this kind can do and are doing. Our larger organizations, our conventions, our national organizations, and even our state organizations have this defect: One year there is one set of men, and the next year you come to the convention, and the personnel is almost entirely changed; but here we have a convention where the personnel changes very slowly. You are mostly gentlemen who obtain your livelihood in the work in which this organization is most interested. You are here year after year. Your work counts. It is not passing; it is enduring. It is helpful. I am glad as a student of municipal conditions to meet a convention of this kind, and to feel assurance that in municipal life in America the tendency is more and more to eliminate politics from tenure of office, and to keep men in office as long as they are the right kind of men. And I am glad to adduce the example of the city engineer's office of the City of Detroit, where we put men in office and we don't care what their politics are—we prefer that they have no politics at all—and as long as, in their work and in their conduct, they manifest a full appreciation of the fact that the shortest distance between two points is a straight line, there they stay. I suppose that is the condition in most of the cities, east, west, north and south, which are represented here in this convention.

The welcome we give you is hearty, sincere and generous. We congratulate ourselves in having a body such as you meeting within our city. We congratulate you that you are here, not for a day's session, but for a good healthful, helpful three-day session. A week session is what conventions of this kind should have.

We are glad to welcome you to this building. It is an auditorium that has been built for the accommodation of the

public in connection with our Art Museum, and every Sunday afternoon this place is jammed full of people listening to lantern illustrated talks on subjects of art and science and sociology, and Saturday afternoons the school children are pouring in here. It is one of the things which, if you have it not in your own cities, we commend to your notice,—one of the best things we can teach you in return for the many things you can teach us. If you have not one, try to get it. It is the best paying investment Detroit has.

The light we turn on here is the light from our city plant which we have owned and operated for twelve years. It has saved us sufficient over what we would have been obliged to pay under contract prices to make the cost of the same stand at nothing on our books. You are welcome to the light. We have our beautiful river and lake boats, which I understand the committee will give you a chance to look at. The beautiful water which we have before our eyes and for our drinks is furnished by our municipal system. We hope to give you a chance to see the largest pumping station in the United States, and I believe, in the world. To all you are welcome. We have saved you a little bit of summer weather, although October's foot has crossed the threshold. We cannot claim that the weather has been made a subject of municipal ownership, because it still requires the adjusting of a few international treaties with our friends on the other side of the river, the Canadians, before we can assume that.

I offer you a sincere welcome to our city. There is a temptation on the part of one, who, I may say, has merely dabbled in municipal politics, to enlarge on an occasion of this kind, and I have trespassed already too long upon your time, because you have a three days' program which must be crowded into two. We wish you success and a pleasant reunion, and we wish you to take away pleasant recollections of the city of which we are so proud, such feelings and recollections as will make you feel, one and all, and as a convention, that you want to come here soon again.

THE PRESIDENT: The First Vice-President, Mr. James Owen, has kindly consented to reply to this speech of welcome.

MR. OWEN: Mr. President and Gentlemen: I feel somewhat embarrassed in making reply to the words of welcome that the President of the Council has delivered to you, and whatever I say must be accepted by you with a great deal of allowance on your part and apologies on mine. For my part, I think that it is eminently proper that a municipal improvement association should meet in the City of Detroit. Judging from my own personal knowledge, I think Detroit is the ideal city of the United States. That reminds me somewhat of a story that was given by an eminent English novelist. He said there was a duel several years ago, fought between an Englishman and a Frenchman. They decided on a duel to the death, and the manner of procedure was this: It was to be fought in a dark room, and after they had done sufficient shooting, then the room was to be opened and the result ascertained. So the two men were locked up in a dark room, there was a good deal of shooting done, and then all was quiet. The seconds to the duelists opened the room and found the Englishman unhurt and the Frenchman up the chimney. The novelist said that whenever he told this story in France, he always put the Englishman up the chimney. So in saying to the gentleman here that I think the ideal city of the United States is Detroit, I do not say it merely because we are here, but I say it from my individual knowledge of many of the cities in the United States and from my personal knowledge of this city. We can do no better while we are here than to examine the different ramifications of city government presented in this city.

The City of Detroit was the pioneer of cities in the pavement movement. They had miles and miles of good pavement in this city before it was heard of in many others. The City of Detroit has an ideal park development. It has what a great many cities have not—I do not know of any other city that has—and that is a three-cent trolley fare. That is an ideal proposition that many other cities are trying to have. It has

ideal water works, and, as I say, it is an ideal city, and I think it eminently proper that this convention should be held here.

In thinking over this question of municipal improvement, it occurred to me that the inhabitants of cities do not appreciate what they get. In the old-fashioned time of country development the father sent his children to the primary school in the winter, and had the dirt turned over in the road in the summer, and that is about all he got from public taxation. A few poor people may have been cared for and a few incidental expenses incurred, but that is about all in primal development that the inhabitant got. Now it is very curious to notice what the growth of municipal development is, and I, as a matter of curiosity, noted down just a partial number of items which are now under the care of the city government, and I wish to impress this upon the community at large, because, as I said before, I do not think the volume of business the city handles is appreciated. In thinking it over I made a memorandum; I may have forgotten some, but the list is as follows: Laying out and opening streets; paving streets; flagging and curbing; constructing sewers, and maintaining them; construction of disposal plants for these sewers and maintaining those; constructing and building water supplies, and maintaining them; constructing and maintaining parks; furnishing light for the public streets, and in many cases maintaining them; establishing and maintaining a police department; cleaning the streets; maintaining a fire department; removal and disposal of garbage; maintaining a department of health; creating and maintaining a system of public schools, including, in the western states, high schools and also colleges; establishing and maintaining public libraries; establishing and maintaining hospitals and dispensaries; maintaining and supporting the poor; the collection and disposal of public moneys, including special assessments, with a regulation for permanent improvements; and also the regulation of business in the shape of licenses for peddlers and for saloons. Now, gentlemen, there is a list of the duties of the public officers of today. Many of

those really come under the function of this association; in fact, I may say that all of them do. Just think of the enormity and extent of the public business of today. Just think of the onus and responsibility put on every municipal organization. And I think if the public appreciated the enormous amount of business done today and for which they pay, they might not be so particular if little lapses, little forgetfulnesses that come upon us, and for which we all have to suffer, should occur. I simply refer to this in passing, and I wish to return thanks to the President of the Common Council for his greeting of us and the consideration and care he evinces in looking out for us; and through him, to thank the City of Detroit for its hospitality and kind greeting, and to express the hope that at no distant future time we may again gather in this city.

THE PRESIDENT: Mr. Heineman begs to be excused, as he has a meeting of County Supervisors to attend.

As the roll call and reading of minutes are generally dispensed with, because the Proceedings have been published, the next thing is the President's address.

ADDRESS OF THE PRESIDENT,

M. R. SHERRERD.

Chief Engineer, Department Public Works, Newark, N. J.

It is appropriate that the American Society of Municipal Improvements, which has among its objects "the promotion of the best methods to be employed in the management of municipal departments and in the construction of municipal works," should meet in "Detroit the beautiful," to obtain the advantage of the object lesson derived from a visit to a city recognized throughout the country as one of our most advanced municipalities.

The purpose of our Society, as expressed in concrete language, scarcely carries with it any idea of the artistic combined with the utilitarian. It must appeal to all municipal workers

that the result of our endeavors should be to create, whether for the state, city, borough, town or suburban section, a better place in which to live; and certainly, for the health and comfort of mankind, the artistic and beautiful is quite as essential as stability and economy, although each factor should be duly considered to arrive at the most satisfactory results.

It would perhaps be appropriate in the President's address to discuss at some length the various works of municipal construction which are now in progress or projected. The various municipal journals have, however, so well presented and given full descriptions of the more important works of this character that it would be superfluous to attempt any detailed reference to these subjects in an address of this kind.

The progress of science and the arts and the almost incredible strides being made to provide what are now considered the necessities of life in crowded communities has been remarkably rapid within the last decade. Nevertheless, the phenomenal growth of cities and the congestion of business activities in restricted areas are constantly creating conditions necessitating additional conveniences for inter-communication between the workshop and the home, with which even the marvelous strides of transit facilities are scarcely able to cope. The transit feature is only one phase of the municipal problem. Many other factors of city growth necessitating radical departures from the methods in vogue only a few years ago will readily suggest themselves to all of us.

Your attention is called in this general way to one feature of our work which shows the importance of careful, conscientious and diligent study, not only of the conditions which confront the municipal officer at the time of his incumbency but demand the best thought of the trained mind to provide for what are likely to be the conditions and necessities of the not far distant future. In considering these broad subjects, certainly such a Society as our should prove of immense advantage in disseminating throughout its membership the experiences of other cities.

To obtain the best results in handling these important problems which confront the smallest as well as the largest of our municipalities, politics should be eliminated from their consideration. It is not meant in using the expression "politics should be eliminated," to convey the idea that tenure of office is the controlling thought. A broader view would suggest that, as the most effective and stable method of arriving at the best results, the municipal officer himself, and particularly the heads of the engineering departments of our city governments, should strive continually and disinterestedly to eliminate politics from his own office as shown in his official reports and advice.

An *esprit de corps* can be established in the engineering department of a municipal government, if properly fostered, which should result in as efficient management of this branch of municipal affairs as is obtained in a large private corporation.

It must be admitted that it is difficult, and some may say it is impossible, that any department of municipal government can be satisfactorily maintained on this basis, but where it has been conscientiously inaugurated and adhered to perhaps with many setbacks, it has certainly resulted in the improvement of the service rendered and in great advantage to the municipality. Such a management of the engineer's department will result in leaving the engineer free to give proper and effectual consideration to the technical problems which confront him. The inauguration of civil service, provided due weight is given to a man's practical experience, would in a measure eliminate the political question in the admission of new employes in the department. To more readily provide that the action of the engineer in charge of a municipal department may be independent of political bias, it would seem advantageous that such engineer act in an advisory capacity for the different public boards with which his duties are concerned, rather than that he should be a member of such boards.

Your President would express his satisfaction at seeing so many municipal officers, other than engineers, who will un-

doubtedly hear discussions on many subjects previously broached or advocated by their engineers at home, and thus be enabled to return to a consideration of these topics with a better understanding of their merits. If this result is accomplished by a discussion of the papers on the program that follows, then our Society has justified the wisdom of our annual gatherings and deserves the enthusiastic, loyal and continued support of its members; thus insuring long life and prosperity to our organization.

The report of the Secretary, George W. Tillson, was then read, and the report referred to the Finance Committee.

ANNUAL REPORT OF SECRETARY.

BROOKLYN, N. Y., Sept. 30, 1907.

American Society of Municipal Improvements.

GENTLEMEN: I herewith submit my report for the year ending September 30, 1907:

RECEIPTS.

Dues	$785 25
Sale of Reports	22 50
Advertisements	44 00
Cash in hands of Secretary September 30, 1906	9 75
	$861.50

PAID TREASURER.

1906.	
October 12	$210 00
November 7	70 00
December 4	120 00
1907.	
January 4	122 50
January 17	50 00
May 12	50 25
April 19	73 00
May 29	31 00
June 4	6 00
August 17	92 00
September 24	36 75
Total	$861 50

The expenses of the office for the year have been:

Postage	$13 86
Printing and stationery	25 40
Freight and express	7 85
Sundries	1 70
	$48 81

The regular routine work and correspondence have been attended to as usual.

The following changes in membership have occurred:

Membership October 9, 1906		170
Elected October 12		56
		226
Dropped for non-payment of dues	7	
Resigned	22	
Failed to qualify	1	
		30
Present membership		196

The Secretary wishes to thank the officers and members for their co-operation during the year.

All of which is respectfully submitted,

(Signed) GEO. W. TILLSON,
Secretary.

Examined and found to be correct.

AUGUSTUS F. EGGERS,
Chairman Finance Committee.

The report of the Treasurer was read by Mr. Tillson in the Treasurer's absence. This report also was referred to the Finance Committee.

ANNUAL REPORT OF TREASURER.

WILMINGTON DEL., Oct. 1, 1907.

American Society of Municipal Improvements.

GENTLEMEN: I submit herewith the report of the Treasurer for the year ending September 30, 1907:

RECEIPTS.

1906.			
Oct. 29	Received from F. J. O'Brien, Treasurer, the balance on hand at last report............	$794 00	
12	Received from G. W. Tillson, Secretary....	210 00	
Nov. 8	Received from G. W. Tillson, Secretary....	70 00	
Dec. 5	Received from G. W. Tillson, Secretary....	120 00	
1907.			
Jan. 5	Received from G. W. Tillson, Secretary....	122 50	
18	Received from G. W. Tillson, Secretary....	50 00	
Mch. 14	Received from G. W. Tillson, Secretary....	50 25	
April 20	Received from G. W. Tillson, Secretary....	73 00	
June 1	Received from G. W. Tillson, Secretary....	31 00	
July 5	Received from G. W. Tillson, Secretary....	6 00	
Aug. 19	Received from G. W. Tillson, Secretary....	92 00	
Sept. 24	Received from G. W. Tillson, Secretary....	36 75	
			$1,655 50

DISBURSEMENTS.

1906.			
Oct. 12	J. J. Curran, for service..................	$5 00	
	Clem Stewart, for service................	3 00	
15	W. D. Pratt, stationery...................	18 00	
	Mildred S. McCreery, stenographic services and postage	75 37	
	F. J. O'Brien, expenses Treasurer's office...	6 50	
Nov. 5	Geo. W. Tillson, services.................	200 00	
	Geo. W. Tillson, Secretary, expenses.......	53 84	
21	Stallings and Montgomery, reporting convention	123 75	
1907.			
Feb. 1	A. P. Folwell, printing...................	4 50	
	T. D. Allin, printing.....................	5 50	
April 11	S. E. Tate & Co., printing................	396 09	
Sept. 23	G. W. Tillson, Secretary, expenses.........	48 81	
			940 36
	Balance at this date......................		715 14
			$1,655 50

(Signed) L. V. CHRISTY,
Treasurer.

Examined and found to be correct.

AUGUSTUS F. EGGERS,
Chairman Finance Committee.

THE PRESIDENT: The Finance Committee and Executive Committee reports will be taken up at the morning session on October 3rd. There being no miscellaneous business, we will now have the paper of Mr. Aldrich, Superintendent of Streets, Detroit, Michigan, on "Street Cleaning Methods Used in Detroit." (See page 73.)

THE PRESIDENT: We will now have a paper by Mr. Rust, of Toronto, Canada, which will be a short description of a sewage disposal plant constructed in Toronto. (See page 135.)

THE PRESIDENT: Mr. Rust will also read the report of the Committee on Sewage. (See page 130.)

THE PRESIDENT: Mr. James N. Hazlehurst, who has written a paper on the "Phenomena of Crushing of Sewer Conduits," is not present. His paper will be read by the Secretary. (See page 140.)

A paper by C. D. Pollock, as member of the Committee on Review, was read in the absence of the author. (See page 70.)

The meeting was then adjourned to meet promptly at 8 o'clock the same evening at the same place. The Executive Committee was asked to meet at the hotel parlors at 7:30. The afternoon of this day was spent by the members of the Society on an automobile ride to the principal points of interest in Detroit.

The meeting convened at 8:30 P. M. Wednesday evening.

THE PRESIDENT: Gentlemen, we are to be favored now by an address descriptive of the City of Detroit by Professor A. H. Griffith, Director of the Museum of Art of Detroit. (See page 204.)

THE PRESIDENT: I think I may take it upon myself to say, in the name of the Society, that we thank you, Prof. Griffith, for your kind address.

On the second day of the convention the constitution provides that the election of officers shall take place, and I shall now call for a Committee on Nominations. Five persons should be selected for that committee. And also five persons should

be selected immediately thereafter to consider the next place of meeting.

The following nominations for the Committee on Nominations were made:

C. H. Rust, E. A. Fisher, E. L. Dalton, James Owen, E. S. Rankin.

On motion, seconded and carried, the nominations were closed. Motion was made, seconded and carried that the Secretary cast the ballot in favor of those names. The Secretary so cast the ballot.

THE PRESIDENT: I shall ask the committee to report at 11 o'clock tomorrow morning.

Nominations for Committee on Place of Meeting were then had as follows:

F. J. Bock, W. M. Wilson, J. W. Howard, Fred Giddings, A. F. Eggers.

On motion duly made, seconded and carried the Secretary was instructed to cast the ballot in favor of the gentlemen nominated. The Secretary so cast the ballot.

THE PRESIDENT: Several committee reports are down on the list for the first day's session, but as some of these reports are not yet ready, I shall call upon Major Howard to read his papers on "Street Paving Work." (See pages 10 and 14.)

THE PRESIDENT: I should like to report for the Executive Committee that they have seriously considered the question as to what the Society should do in regard to the exhibits of the Associate members, and feel that some definite action should be taken by the committee in order to take care of such exhibits next year, and the recommendation of the Executive Committee is that the question of the appointment of a committee for the exhibits, or the question whether a committee should be appointed or not, be left to the incoming officers.

I would also say that the Executive Committee recommend for the approval of the convention the appropriation of $500.00 to the Secretary's office for additional help to the Secretary, in addition to the salary which is now given to the Secretary, which is $200.00; the reason for this being the desire on the part of the Executive Committee to see that some continuous

systematic work may be carried on throughout the year to acquaint the officers of the cities throughout the country of the objects of the Society, with a view to increasing the membership if possible, and also to be of use to the members in the collection of municipal data. I think that one feature and one way at least in which such an assistant to the Secretary could be of special use to the membership would be by collecting and keeping in his hands data that could be asked for by the different cities, and also that incidentally the membership of the Society might be materially increased by the members referring requests for information to the Secretary's office. I would suggest that, if the membership of the Society could,—and I think it might be brought about in a few years,—they should take the position that they are not going to take the time to answer these general requests for information unless they come from members of the Society, and that when such requests come to the engineers for information, we can reply to the person making the request that if he becomes a member of the Society the Secretary's assistant will attend to the collection of what data he may need. That would then be one of the functions of the office. This comes under the report of the Executive Committee. What is your pleasure in regard to it?

MR. HOWARD: Does that contemplate the man being called Assistant Secretary?

THE PRESIDENT: We did not consider that matter very fully. I might add that the Society, while it is true that it is just about paying its way from year to year, now has $700.00 in the Treasury. At least a part of this money will be needed for issuing the publication, but after this meeting we will have sufficient funds to issue the publication and to appropriate this money, and we hope that, as the result of the labors of an assistant or clerk so detailed to help the Secretary, the amount received from dues will more than make up for this expense. Certainly some radical departure should be made in order to either increase our membership and to expressly consider just

what should be done for the benefit of the Society. If agreeable I will entertain a motion that the recommendation of the Executive Committee be approved.

MR. RUST: I move you, Mr. President, that the recommendation be approved.

MR. HOWARD: I second the motion.

The motion was thereupon put by the President and duly carried.

THE PRESIDENT: I will call for the report of the Committee on Taxation and Assessment, by Mr. W. H. V. Reimer, chairman, East Orange, N. J. Mr. Reimer expected to come to the convention but he was detained on some matters there.

Mr. Hatton gave us a very exhaustive report on this subject last year, and he wrote me he had requested some papers on this matter. There is one here in the hands of the Secretary, "The Final Disposition of Garbage," by F. P. Smith, of Chicago, and I will ask the Secretary to read it. (See page 164.)

Mr. William A. Howell, Engineer Streets and Highways, Newark, N. J., was then called upon for his paper on "A Recent Investigation of Various Bituminous Materials Used in Expansion Joints of Brick Pavements," and he thereupon read the same. (See page 34.)

Adjournment was then taken until 9:30 Thursday morning, October 3rd.

THURSDAY, OCTOBER 3, 1907.

Meeting called to order at 10:20 A. M. in assembly room, Hotel Cadillac.

THE PRESIDENT: I will ask for the financial report to be given by Judge A. F. Eggers.

Mr. Eggers makes report certifying to correctness of financial account.

On motion, duly seconded and carried the Society accepted said report.

THE PRESIDENT: I will now call for the report of the Committee on Electric Street Lighting by Mr. E. A. Fisher, of Rochester, N. Y. (See pages 100 and 103.)

THE PRESIDENT: Mr. L. H. Weissleder, of Cincinnati, O., another member of this committee, will also give us a paper on this subject. (See page 116.)

Following this paper and a discussion upon it, this motion was made by Mr. Parkes:

I simply rise to move that the Committee on Street Lighting be instructed, if possible, to bring in a specification that might be included in our contracts for street lighting, so that we could determine the illumination furnished by the corporation.

MR. FOLWELL: There is a committee of experts on street lighting which are wrestling with this question, and although we have several members here who are themselves experts, it is doubtful whether we could get as large a committee of experienced experts as that society and whether the results we could obtain would be as generally recognized as the results of that committee. It seems to me that Mr. Brown's idea, that we wait for a report and instruct our Committee on Street Lighting to inform us from time to time what that report is, would be the best thing to do.

MR. PARKES: I accept with pleasure Mr. Folwell's suggestion. I still think the committee might keep this before them. I modify my resolution so that it may read that the Committee on Street Lighting bring in a report with such information as

they may be able to obtain and which they think of interest to this Society in regard to the measurement of illumination furnished by the electric lighting company to the city.

(Motion put and carried.)

THE PRESIDENT: William M. Daly, of Detroit, Superintendent of the Light Department, will now read his paper. This is in connection with the report of the Committee on Electric Street Lighting.

MR. DALY: Mr. President and Members of the Society: I will try to give you an idea of how we started in Detroit and a history of our plant. (See page 109.)

Moved, seconded and carried that Mr. Daly be tendered a vote of thanks for his paper.

At this point the convention was adjourned to meet at 8 o'clock P. M. in the Assembly Room, Hotel Cadillac.

Meeting called to order at 8:15 P. M. at Hotel Cadillac.

THE PRESIDENT: The Nominating Committee will now make its report.

MR. RUST: Your committee recommend the following nominations for your consideration: President, George W. Tillson, Brooklyn, N. Y.; First Vice-President, James Owen, Montclair, N. J.; Second Vice-President, Julian Kendrick, Birmingham, Ala.; Third Vice-President, Fred Giddings, Atchison, Kan.; Secretary, A. Prescott Folwell, New York City; Treasurer, Leslie V. Christy, Wilmington, Del.; Finance Committee, A. F. Eggers, Newark, N. J., T. C. Hatton, Wilmington, Del., R. H. McCormick, Detroit, Mich.

THE PRESIDENT: You have heard the recommendation of the committee, gentlemen. What is your pleasure?

MR. HOWARD: I move that the recommendations be concurred in and that the President be directed to cast the ballot for our officers.

(Motion seconded and carried. The ballot is so cast.)

THE PRESIDENT: If there is no objection I will appoint the Committee on Resolutions as follows: A. Prescott Folwell, G. M. Ingram and Julian Kendrick.

Mr. Ackerman will now favor us with a paper on "Conduits."

MR. ACKERMAN, of Auburn, N. Y.: I will briefly state that some short time prior to this meeting I wrote to the Secretary and inquired if there was going to be any paper on municipal electric conduit work, and thinking that perhaps there would be, I put in my pocket just a few data which we had in our own town, expecting that I might be able to discuss the proposition. Mr. Tillson wrote me a letter asking me to prepare a paper on it that might start the discussion going. That letter followed me here and found me here simply with the data which I had brought along. I have done what I could in elaborating that. (See page 123.)

THE PRESIDENT: We will now ask the Committee on Next Place of Meeting for its report.

MR. BOCK: Mr. President and Gentlemen: Your committee has considered the claim of various cities and have concluded to report to the Society itself and ask that the members here tonight decide definitely after stating the situation as it is before the committee. There are numerous invitations before us. After considering the claims of cities which have sent invitations to the Society, the committee has decided—or at least, one city which has sent an invitation, that is Atlantic City, has been very favorably thought of by your committee. Some members of the committee have advocated the selection of Baltimore as the place of the next convention, the reason stated being that from an engineering standpoint Baltimore at this time and in the near future will hold out more features of interest. We would, therefore, respectfully ask this association, if it sees fit, to decide as to the respective merits of Atlantic City, which has sent an invitation to the Society, and

Baltimore, from which we have no definite invitation. The committee, in deciding to recommend Atlantic City as the possible place for meeting next year, is induced to favor that city because, in the opinion of the committee, many other attractions aside from the convention itself would be found there, providing the convention were held at the proper time of year, and that would, in our opinion, cause a very large attendance and we feel that that is essential at this time. We would ask the convention to decide that question for themselves.

Motion was made by Mr. Weissleder that Atlantic City, N. J., be chosen for the next place of meeting. Motion was seconded.

Informal discussion by Messrs. Parkes, Ingram, Owen, Brown and Tillson.

MR. A .R. DENMAN, of Newark, N. J.: I ask the favor of the chair for a moment. It has been remarked in my hearing, not once or twice, but half a dozen times last year and this year, that the immediate objects for which this Association stands warrant a wide advertisement for it. We have been at our wit's end in discussing the matter how best to bring this association and its purposes before the greatest number of towns and cities which would naturally be interested in its work. We think, from the list of officers that have been elected for the ensuing year, that the Society has put forward its very best men to exploit this association and the importance of its work. It seems to me that it is equally necessary that we should endeavor to get the widest publicity by putting forward the most available place, the most attractive place that will bring people from the interior, if you please; not the people who live along the Atlantic seaboard, but people who come all the way from Arkansas, and who like a dip in salt water once in a while; and we want every town in Arkansas interested, not only Pine Bluff, Arkansas, but all the Pine Bluffs, and any of the rest of the cities, and I submit that Atlantic City is the proper place to advertise this convention. And before we meet there may I also suggest, if I am not too much out of order, that some sort of a publicity committee or

a publicity enterprise be put in motion in order to acquaint the towns and cities, not only the technical gentlemen who come here, but there are a great many people interested in these subjects who are not technical engineers. Let them all know what is going on, that they are going to Atlantic City where there is plenty of hotel room and all sorts of attractions. At the same time we want some kind of a brake on that will insure the attendance of the delegates to the meetings of our convention, and not to the penny shows that are on every hand at Atlantic City. Therefore, I would urge that, in addition to this publicity business, we decide on Atlantic City, and then, by combining the two, the public place and the public advertisement, see if we cannot make the attendance instead of between eighty and ninety, between eight and nine hundred at our next meeting.

Upon calls of "question," the motion that Atlantic City be selected as the next place of meeting was carried.

THE PRESIDENT: I would like to state to the convention that the National Municipal League has sent a representative to this convention, and I would ask the indulgence of the meeting while this representative talks to us about the objects of their League, and I will now call upon Mr. Freiberg, of Cincinnati, Ohio, who represents the National Municipal League, which meets, I believe, at Providence, R. I., in November of this year, to speak to us.

MR. FREIBERG: Mr. President and Gentlemen: I have been listening to your proceedings for the last two days and am therefore much interested in the remarks made by the previous speaker to the effect that many persons besides electrical and civil engineers are concerned in your doings. The National Municipal League is an organization formed many years ago, probably before your organization was, for the purpose of studying and dealing with and forming conclusions on the vitally important subject of city government. I do not know whether there was an invitation from your Society to my

Society to send a delegate, or whether there was a request on the part of my Society to send a delegate. I have never been able to find that out. Some six months ago I received a request from Mr. Woodruff, of Philadelphia, our Secretary, inquiring of me whether I would be willing to come to this meeting, and I responded that I would be only too happy if my time permitted, but I have never been able to find out my function in coming here and your Secretary is not able to give me that information, so I propose to cut the Gordian knot by explaining the purposes of my Society and to throw out a suggestion or two.

The President of the League is Mr. Bonaparte, now Secretary of the Navy, who has been President of the League for seven or eight years, since the death of Mr. Carter, of New York; and I might say Mr. Bonaparte gives much time to the matters of the League. He is called in this country the "Prince of Reformers." I must say at the outset that our organization is properly called a society of reformers, although we do not lay particular stress on the name. We are reformers only in the sense that we feel that the present conduct of city governments is not what it should be, and we spend our time both at our meetings and during the year in studying the plans and devising possible systems of government so as to contribute a part in the reformation of our city government. I cannot conceive how any body of men could be more interested in this question than the American Society of Municipal Improvements. You, gentlemen, are very much concerned in the development of your own cities and of your special line, but before you can do that work you must have that power behind you; you must be unimpeded. I noticed in the President's opening address that principle of fundamental importance—that all politics should be kept out of the work of the city engineer. There is nothing truer. Now the National League has gone to some extent into those questions. Of course we do not go into them technically as you do, but we are interested very widely, for instance in the question of municipal accounting.

I learned last night in one of the papers of the meeting, of a uniform basis on the subject of density, that you must have a uniform basis before you can make comparisons. One of the great desiderata in American municipal statistics has been the lack of uniformity. It has been absolutely impossible in the past to make comparisons as to the cost of material or of certain experiments in government, because there has not been any rational systematic attempt to unify the bases upon which these statistics are set forth. For instance, the subject of vital statistics. There was a question relating to street cleaning in which certain references to data on the subject of public health were made. I must insist that it is absolutely impossible today to arrive at any conclusion on that subject because there are no definite bases universally accepted by all cities. Our League has taken the matter up and has been very successful in having their system of municipal accounting introduced in quite a number of large cities in the country. We also take up the question of municipal ownership, a very widely discussed question it is true, and yet you can see that in subjects like that your Society will necessarily touch the work of our Society, although, as I say, we are not concerned with purely technical questions. Our League has a membership of, I think, 1,200, and that membership is distributed among all the states in the United States. Some of the foremost citizens of the country are active members of this League. We have 1,146 members. The income of the League last year was $9,337.00. We have a secretary, paid, I think, $3,000.00 per annum. A great deal of money is spent for postage and for exploiting the purposes of the League. Now it probably occurred to the officers of my Society in casting their eyes about and noting the activities of your Society, that if there is any overlapping of work or any possibility of combining the activities of the various societies, it would redound to the benefit of all. It occurred to me while I was sitting here listening to your troubles as to getting members to your meetings and the difficulty of advertising, that if, at some remote day, your Society might become an

auxiliary or closely affiliated with ours, you would gain the benefit of all this secretarial work, this exploiting, and publication, and would also have with you a very considerable body of important men in this country who would be made cognizant of the efforts you are making and would perhaps be of some assistance to you. On the other hand I am absolutely certain that the conclusions you reach at your meetings will be of countless benefits to the members of our League. I am a little bit sorry that the meeting place has been decided on, not because Atlantic City is not a good place, but because it occurred to me that if it were possible for this Society to have its meeting at the same place, nearly at the same time with our League, where our League will have its meeting perhaps at some time in the future so that you could experiment on the subject of a closer affiliation without committing yourselves to anything definite, that that might be well. Unfortunately this time we changed our meeting from the spring until fall. We meet this year at Providence, R. I., but I hope that at the next time we may hold our meeting at the same place. I don't know whether that would be possible or not because we met at Atlantic City last year—and I might say in passing, without being at all impudent, that we found it a rather poor place to meet in; not because it didn't attract a large number, because we had more there than ever before, but the members did not come to the meetings; they kept walking up and down the board walk. Our League is concerned with such things as primary reform, devising a better system of charters for cities. Questions such as municipal ownership of public utilities come up from time to time, and things of that sort; and also, principally I may say, in an attempt to make it less possible for the boss system to prevail in our American cities than it is today. Now your Society, apart from your technical interest, must have a deep concern in these questions and our people doubtless have felt that you might be of great assistance in helping in their solution.

MR. RUSSELL, of Detroit: I would like to say a word as an

outsider; that is, simply spread yourselves. I knew absolutely nothing of your meeting here until I received a postal card from my friend over there who told me he was to arrive in Detroit on a certain day on account of this meeting. If your publicity committee could only get to work and interest the cities, I am sure that in the other cities of the country in which you meet you would find that men interested in city questions and who had the interests of the commonwealths at heart would be right with you all the way through. If you could only get out and interest the public I am sure that there would have been, not only one of the laity of the City of Detroit here tonight, but two hundred or more, interested in city improvements and the electric lighting and all the other things you men are interested in, who would help you all the way through. If you could only get your publicity committee working in Atlantic City or in Baltimore, or wherever you meet and get the laity interested, they would all be with you and do what they could. Here in Detroit we have all sorts of schemes that the engineers are interested in and we don't know about them simply because we don't have a chance.

MR. HOWARD: I wish Mr. Freiberg might read the list of the committees of their organization.

MR. FREIBERG: Committee on Taxation, Committee on Work Among College Men, Committee on Co-ordination of University and Collegiate Instruction in City Government, Committee on Business Bodies. I would like to add one more suggestion. It may be possible that there is too much duplicating of work in this country. There is a League known as the League of American Municipalities, your organization, and ours, and while I am positive that a great deal that goes on in your meetings would not touch our meetings, yet there are places where they do touch, and I am sure you are all interested in the work being done by our Society. I hope that some day either our organization may be an auxiliary of yours or yours of ours.

THE PRESIDENT: I would say that the Secretary and President have had some correspondence with Mr. Woodruff of the National Municipal League, and I will ask the Secretary to explain that correspondence.

THE SECRETARY: There has been more or less talk of some assimilation or co-ordination in the work of these different societies for some time, and last fall and during the winter I had some correspondence with Mr. Woodruff with a view of bringing something of that kind out during this meeting, but the correspondence was so long ago that I am not able to say just what it was that prevented the action. When it was decided that we couldn't get together—I think it was because the time and place for the meetings of both Societies had been decided on so they could not be changed—then Mr. Woodruff suggested that if we could not get together, it might be possible for their association to send to us a delegate or two, which suggestion was, of course, gladly acquiesced in by the officers of this association, and it has resulted in Mr. Freiberg being with us at this meeting, and whose talk we have enjoyed very much.

MR. BROWN: This is a matter in which I have been very much interested for a number of years. The first way in which this came before the Association was at our Rochester meeting, at which we received an invitation from the American Civic Association to join in the consideration of the combination, or at least the affiliation, of about four organizations working in this field. At that time it did not seem possible for any sort of combination to be made and the matter was quietly dropped, but afterward there was more or less discussion of it, and in connection with the civic week at St. Louis there was some little bit of getting a little closer together. The gist of the talk was that the three associations, the Civic League and this association and the League of American Municipalities all meet the same week, and a few of us got together, but it didn't amount to anything at that time. The most of my speech is

contained in my presidential address at Birmingham last year, and my idea at that time was that this association get into correspondence with Mr. Woodruff to see if we could not get together this year. The Secretary has told you the result of that correspondence. I myself am very glad it has resulted in Mr. Freiberg coming to us, because I feel we are getting closer and it may be possible sometime for us to get together. I feel we cannot emphasize too much the desirability of the same time and place of meeting, so that we can as individuals take advantage of all three of these associations; the American Civic Association and the National Municipal League meet together this year, and it seems to me we could do the same thing. Therefore I feel like asking the Executive Committee of our association to do all they can to aid in getting the three associations to at least meet at the same time and place.

MR. PRESIDENT: I wish to, in the name of the Society, thank Mr. Freiberg for his appearance here and his talk to us.

MR. FREIBERG: I wish to tender an invitation to this organization to send delegates to our coming meeting.

MR. BROWN: I should like to offer a resolution that the Executive Committee take this metter up for careful consideration, and if they have power, that they appoint a committee of one or two or three to meet with the National Municipal League and the American Civic Association at their next convention and proceed with the matter of arranging for a joint meeting, or a meeting at the same time and place, if it is possible to make that arrangement for the next year or the year after. If there is no meeting of the Executive Committee before the close of this convention, that the President and Secretary be empowered to select the delegates.

The motion is seconded by Mr. Owen, voted upon and carried.

MR. HOWARD: If this Society would authorize its Secretary to furnish to the National Municipal League a list of its members, doubtless the League would send an invitation to those

members as individuals. I move that the Secretary furnish a list of our members to the National Municipal League.

Motion seconded and carried.

The report of Mr. Allan Dow on Street Paving was not read, but ordered printed in the Proceedings.

The paper of Mr. J. B. Hittell, Chief Engineer, Board of Local Improvements, Chicago. Ill., on "The Guarantee Clause in Paving Specifications of the City of Chicago," was read by Mr. Dow. (See page 85)

THE PRESIDENT: We will now have a discussion of "Guarantees From the Contractor's Standpoint," by Mr. W. H. Andrews, of Hamilton, Ohio. Mr. Andrews is not here and the paper will be read by Mr. Dow.

MR. DOW: This was written as a letter because the contractor did not have time to get up a paper on the subject. It was my idea to get a number of letters from contractors, because it is a matter that must be gone into with more forethought than has been given to it in the past, because I think we will find in the future that a number of cities will be left with poor pavements on their hands and guarantees of no use to them. (See page 98.)

THE PRESIDENT: Mr. Tillson will read a paper on "Treating Wood Block for Paving Purposes." (See page 21.)

THE PRESIDENT: I will ask Mr. Folwell instead of the Secretary to read a paper written by Mr. George T. Warren, of Boston, Mass., on "Backfilling Trenches." (See page 59.)

THE PRESIDENT: I will call for the report of the Committee on City Government and Legislation, by Mr. Andrews. (See page 181.)

The following names were then presented to the Society as applicants for membership therein:

CORPORATE MEMBERS.

G. W. Tonson, Director of Public Service, Toledo, Ohio.

F. T. Elwood, Commissioner of Public Works, Rochester, N. Y.

Daniel B. Goodsell, Assistant Engineer, Bureau of Highways, Borough of Manhattan, New York City.

W. B. Fuller, Engineer in Charge of Filtration, Department of Water Supply, Borough of Manhattan, New York City.
James J. Smith, City Engineer, Grand Forks, North Dakota.
Frank L. Marston, Consulting Engineer, Stockton Springs, Maine.
Jacob Haussling, Mayor, Newark, New Jersey.
George H. Lambert, Commissioner Board of Works, Newark, New Jersey.
Thomas F. Halpin, Commissioner Board of Works, Newark, New Jersey.
William A. Howell, Engineer Streets and Highways, Newark, New Jersey.
John H. Ely, Architect, Newark, New Jersey.
W. C. Campbell, Superintendent Public Works, Columbus, Georgia.
J. E. Putnam, Assistant City Engineer, Rochester, N. Y.

Associate Members.

Otto C. Plessner, Chicago, Illinois.
P. C. Reilly, Indianapolis, Indiana.
W. P. Blair, Terre Haute, Indiana.

Upon motion, duly seconded and carried, the Secretary was directed to cast the ballot of the Society for the gentlemen whose names appear above. The Secretary cast the ballot, and the gentlemen above named were declared elected to membership.

Adjournment was then taken until Friday morning, October 4th, at 9:30, meeting to be held in assembly room of Hotel Cadillac.

FRIDAY, OCTOBER 4, 1907.

Meeting called to order at 10:30 A. M.

THE PRESIDENT: We have some more papers on street paving, subjects falling within the scope of Mr. Dow's committee. Mr. Dow, will you present the papers?

MR. DOW: This is a paper by Mr. E. A. Harper, city engineer of Kansas City, Mo., on "Some Efforts Being Made to Improve the Asphalt Pavements in Kansas City." (See page 55.)

THE PRESIDENT: We will have next the paper of Mr. F. P. Smith, Consulting Chemical Engineer of Paving, New York City, on "What Steps Should a City Take to Insure Good Asphalt Pavements?" I will ask the Secretary to read this paper. (See page 40.)

THE PRESIDENT: Mr. Owen has kindly consented to give us a report on "Park Development and Maintenance."

MR. OWEN: Our committee has not been very energetic, but I should like to give you a few thoughts on the park question, so that it might create a little interest in that branch of municipal development, so I have put a few thoughts down. (See page 171.)

THE PRESIDENT: We have next two papers on "Fire Protection"; one will be read, and the other, which is somewhat long, will, if there are no objections, be read by title. (See pages 192 and 195.)

Mr. Howard then gave a synopsis of the report of the Committee on Municipal Data and Statistics. This report is to be submitted later.

Announcement was made that Mr. Davis, of the Entertainment Committee of Detroit, would arrange to take the members of the Society to any particular point of interest they might wish to see. The asphalt plant and municipal lighting plant were suggested.

Mr. Folwell was asked to take the chair.

MR. HOWARD: I move that a vote of thanks be tendered Mr. Sherrerd for his efficient and constant interest in the Society

in the several offices he has held, and particularly as President, from which office he has just retired.

The motion is seconded by Mr. Owen and unanimously carried.

MR. SHERRERD: I thank you, gentlemen. In relinquishing the chair as President of this association to one whose familiarity with its work and whose constant efforts in support of the Society will make him eminently fitted for the office, as will his affability and his executive ability to carry on the work of this Society, I wish to thank the members for their hearty support during the year and for their attendance at this convention.

MR. PARKES: There are one or two things I wanted to ask the Society to refer to the incoming officers,—the President, Secretary, and First Vice-President, for they all seem to be from the same section of the country, which things will really be a benefit to the Society. Though a comparatively new member of the Society, I yield to no man in my devotion to it. I think we have a good organization, and we want to keep it up, and we want to do all we can to make it interesting and instructive to our members, and to make our councils and the other people at home to understand that this is something profitable for them to attend. One little thing has forcibly struck me, and that is the question, "Who is that?" It is not everybody, who, like some of us, is willing to rush right in and ask who so and so is. There are some times new members and they want to see a certain man about some particular thing. I want to offer the suggestion, first, that the incoming officers, as I have stated, consider the advisability of adopting a numbered badge to be used at the meeting, and of posting at the convention hall or of giving out to the members a list of the membership with the number corresponding to that on the badge, so that on seeing a man who has badge No. 14, you will know who he is. Second, I want also, since we have given the Secretary clerical assistance, to see it so that any member of this association is entitled, and is desired, to inquire through

the Secretary of other members for information about municipal data. I don't mean advice, but if he wants to know what the cost of something is in certain towns of a certain size, he can write to the Secretary and the Secretary get the information and return it to him. Third, I want to suggest the advisability of adopting an official device in the way of a little shield or something that can be recognized, something that can be printed and furnished by the Secretary, say at cost, printed on the stationery, so that if you get a letter from a man you will know that he belongs to the Society.

MR. OWEN: I heartily endorse these suggestions, and will make a motion that the President be given power to carry them out.

Motion seconded and carried.

After numerous demands for a speech,

MR. TILLSON: It is a pleasure to any one to be elected as President of a Society that stands for and has done as much as this one has. Personally, I have been interested in it for ten years, and for six years I have acted as Secretary. I feel that the little I have done for the Society has been more than repaid, even if there were no financial remuneration, by the benefits I have received from it; and I feel very much surprised that it has seemed so hard to enlist other engineers or officials outside of those with which we are acquainted in the meetings and in the work which is being done, and it seems to me it is principally because they have not, in some way or other, been thoroughly informed as to just what we are doing. Because every one who does come and hear the proceedings is particularly pleased, not only with what is said, but with the business way in which things are conducted. By that I mean the taking up of subjects of interest in different cities. The gentleman here from Cincinnati said that he was very much pleased to find that we were talking about matters of importance to the different cities, and while we have a membership now of but two hundred, it does not seem that there should

be any difficulty in making it six or eight hundred. I know, however, there is, because I know what I have done in the past and what other members have done; but it does seem that, if some means could be devised by which we could interest other people, instead of having a convention of sixty or seventy, we might have one of two or three hundred. There is one feature of this convention of which I want to speak, and that is the attendance among the southern members. Two years ago, when we decided at Montreal to go to Birmingham, I had a feeling that it was a mistake; but the developments of the past two years have satisfied me that it was not a mistake but the best possible thing that we could have done. We took in quite a number of new members from the south last year, and although the distance they had to travel to come here would average very much more than that traveled by any of the northern members, the percentage of attendance of the southern members has been about double that of the northern members, and I have been particularly gratified by it, and I hope that next year, when we have Atlantic City with the attractions of the sea, and, incidentally, the baths, we may still have a large attendance from the south. I wish to say that during the coming year I will not only do, but gladly do, everything that is in my power to make the Society a success and increase its membership, so that we may feel that we are doing more for ourselves and more for the country than we have done in the past.

Thereupon the convention adjourned, to reconvene at Atlantic City, New Jersey, the date to be subsequently fixed.

CONSTITUTION OF THE SOCIETY.

ARTICLE I—Name and Object.

Section 1. The objects of this Society, which shall be known as "The American Society of Municipal Improvements," shall be to disseminate information and experience upon, and to promote the best methods to be employed in the management of municipal departments, and in the construction of municipal works, by means of annual conventions, the reading and discussion of papers upon Municipal Improvements, and by social and friendly intercourse at such conventions, and to circulate among its members, by means of an annual publication, the information thus obtained.

ARTICLE II—Membership.

Section 1. Any municipality within America shall be eligible to membership in this Society; likewise any engineer, officer, or director who shall have charge of or supervision over or be employed as a consulting engineer on any public or municipal department work.

Any member who shall have ceased to have charge or supervision of any public or municipal department or work may retain his membership, unless he shall have come under the restrictive requirements of associate membership, when he shall retain membership as an associate only.

Sec. 2. Every application for membership shall be in writing, stating the name, location and department, if any; and, if of an individual, shall also state age, residence and position of the applicant, if any.

Sec. 3. Any proper person interested in municipal improvements or work as a contractor or contracting agent or who is a manufacturer or dealer in municipal supplies, may become an associate member, who shall enjoy all the rights and privileges of full membership, excepting that of holding office or voting.

Sec. 4. Any member who shall be in arrears for more than one year's dues shall be considered as no longer a member of this Society, and his name shall be discontinued from the roll by the Secretary.

Sec. 5. Any member may withdraw from the Society upon payment of all dues to date, and by notifying the Secretary thereof in writing.

Sec. 6. Any member may be expelled from the Society upon the recommendation of the Executive Committee adopted by a two-thirds vote of all the members present.

ARTICLE III—Fees and Dues.

Section 1. Each corporate member shall pay five dollars per annum, and each associate member shall pay ten dollars per annum. All dues to be payable in advance, on or before the date of the annual meeting.

ARTICLE IV—Officers.

Section 1. The officers of this Society shall consist of a President, three Vice-Presidents, a Secretary, and a Treasurer, not more than two of whom shall be a resident of the same state, and who with the Past Presidents who have retained their continuous membership shall act as an Executive Committee for and in behalf of the Society.

Sec. 2. There shall also be elected a Finance Committee consisting of three members of the Society.

Sec. 3. In case of any of the above positions, excepting the presidency, becoming vacant, or in case of their absence during the annual convention, the President shall fill such vacancy by appointment from the membership.

Sec. 4. There shall be appointed annually the following standing committees:

1. Street-Paving.
2. Electric Street-Lighting.
3. Sewerage and Sanitation.
4. Waterworks and Water-Supply.
5. Taxation and Assessments.
6. City Government and Legislation.
7. Disposition of Garbage and Street Cleaning.
8. Review.
9. Municipal Franchises.

The number of each committee shall be three, and the Chairman may add such names as he may deem advisable. No special or standing committee shall be authorized to create any liabilities unless the same shall have been first approved by the Executive Committee.

ARTICLE V—Election.

Section 1. The officers of this Society shall be elected by ballot on the second day of each annual convention, and each municipality shall be entitled to as many votes as it has representatives present.

Sec. 2. The President shall not be eligible for immediate re-election (except by a unanimous vote).

Sec. 3. The officers elected shall assume office immediately after the close of the annual meeting at which they were elected.

Sec. 4. The ballot for any officer may be waived by unanimous consent.

ARTICLE VI—DUTIES.

Section 1. The President shall preside at the meetings of the Society and at those of the Executive Committee, and shall perform such other duties as are incumbent upon the office. In the absence of the President, or upon his becoming ineligible, the senior Vice-President shall assume and perform the duties of the office.

Sec. 2. The Secretary shall keep accurate minutes of the proceedings of the Society and of the Executive Committee; shall conduct all correspondence; shall issue notices of any meeting of the Society not less than four weeks prior to the date of such meeting; shall collect and receipt for all fees and dues and pay them to the Treasurer quarterly, taking his receipt for the same; and keep accurate account between the Society and its members.

Sec. 3. The Treasurer shall receive from the Secretary and safely keep all moneys belonging to the Society, giving his receipt therefor; shall pay all bills approved by the Finance Committee or the President; shall keep correct account of the funds of the Society, and submit to it at its annual meeting a report of all receipts and disbursements during the preceding year.

Sec. 4. The Executive Committee shall manage all the affairs of the Society, subject to the action and approval of the Society at its meeting. All questions in Executive Committee shall be decided by a majority vote, and five members shall constitute a quorum, not less than four of whom shall be officers of the Society. The Executive Committee shall meet at least once each year, on the morning of the first day of the annual meeting of the Society, and as much oftener as the President may determine. The Executive Committee shall be directed to keep an accurate list of the members of the Society, and to ascertain from time to time whether or not such members are still municipal officers, and if not, to take such steps as may be necessary to secure new members from such cities in which members of the Society are no longer municipal officers—this with a view of insuring the permanency of the association, as well as maintaining and increasing the membership thereof.

Sec. 5. The Finance Committee shall meet on the morning of the first day, and previous to the annual meeting of the Society, to examine and audit the Secretary's and Treasurer's accounts and annual statements, and report thereon to the Society.

Sec. 6. It shall be the duty of the Chairman of each standing committee to prepare a report, with the aid of his fellow-committeemen, and submit the same at the annual meeting.

Sec. 7. One afternoon, and such other time as may be deemed necessary, shall be devoted to sectional work, the Chairman of each standing committee acting as Chairman of the section. The Chairman of each section shall arrange the program of the sectional meetings in connection with the Program Committee of the Society.

ARTICLE VII—MEETINGS.

Section 1. The annual meeting of the Society shall be held on the second Tuesday in October of each year, in such city as the majority of the members voting shall decide; selection of place of meeting to be made after the officers shall have been elected. Provided, however, that the date may be changed for cause, with the approval of two-thirds of the Executive Committee, all the members to be notified of such change in accordance with Article VI, Section 2.

Sec. 2. At any annual meeting of the Society twenty members shall constitute a quorum for the transaction of business.

Sec. 3. Any member, with the concurrence of the presiding officer, may admit friends to the meeting of the Society, but such person or persons shall not without the consent of the meeting be permitted to take part in any discussion.

Sec. 4. All papers, drawings, etc., submitted to the meeting of the Society shall be and remain the property of the Society.

ARTICLE VIII—ORDER OF BUSINESS.

Section 1. At the annual meeting of the Society the order of business shall be as follows:

1. Roll call.
2. Reading of minutes of last meeting.
3. Considering of applications for membership.
4. The President's address.
5. Reports of the Secretary and Treasurer.
6. Report of the Executive Committee.
7. Report of the Finance Committee.
8. Reports of special committees.
9. Reading and discussion of papers.
10. Election of officers.
11. Selecting next place of meeting.
12. General business.

Sec. 2. All questions shall be decided by vote, and all differences of opinion in regard to points of order shall be settled by parliamentary practice as set forth in Cushing's Manual.

ARTICLE IX—AMENDMENTS.

Section 1. The foregoing constitution and articles may be amended on or after the second day of any annual meeting of the Society by a two-thirds vote of all members voting; provided such proposed amendment shall have been submitted to the Society in writing on the first day of its annual meeting.

BY-LAWS.

No. 1. Members shall not be permitted to give out for publication any papers, to be submitted to the Society at its annual meeting, in advance of such meetings; and all requests for papers for such purposes shall be referred to the Secretary.

No. 2. All committees and members of the Society shall be required to furnish four copies of all reports, papers or other matters submitted to the Society for its consideration.

No. 3. It shall be the duty of the President, on or before the 1st day of January of each year, to divide America by States into Territorial Sections, and to assign one or more members of the Executive Committee to each of said sections. It shall be the duty of the members of the Executive Committee thus assigned to keep an accurate list of the municipalities and members of the Society in the particular territory assigned to them, and to ascertain, from time to time, whether or not the members of the Society from the territory assigned to them are still municipal officers; and when not, to take such steps as may be necessary to secure new members from such municipalities, as well as to secure membership in the Society of such municipalities and officials in the territory assigned to them that have not acquired the same in the past.

No. 4. The President shall be required, at least sixty days before the holding of the annual convention, to communicate with the local committee having charge of the arrangements of the convention in the city in which the same is to be held, with a view of securing exact data as to place of meeting, entertainment to be furnished, hotel and railroad rates, etc., and to print this information, together with such data relating to the business of the convention as he may have, and turn the same over to the Secretary, or members of the Executive Committee, for distribution.

OFFICERS OF THE SOCIETY

FOR THE YEAR

1907-1908.

President	GEO. W. TILLSON	New York, N. Y.
First Vice-President	JAS. OWEN	Montclair, N. J.
Second Vice-President	JULIAN KENDRICK	Birmingham, Ala.
Third Vice-President	FRED GIDDINGS	Atchison, Kan.
Secretary	A. PRESCOTT FOLWELL	New York City.
Treasurer	L. V. CHRISTY	Wilmington, Del.

Finance Committee

A. F. EGGERS, Chairman	Newark, N. J.
T. C. HATTON	Wilmington, Del.
R. H. McCORMICK	Detroit, Mich.

Executive Committee

The officers of this Society, together with the Past Presidents who have retained their continuous membership, constitute the Executive Committee. The Past Presidents are as follows:

Past Presidents

M. J. MURPHY	St. Louis, Mo.
GEO. H. BENZENBERG	Milwaukee, Wis.
AUG. HERRMANN	Cincinnati, Ohio.
HARRISON VAN DUYNE	Newark, N. J.
NELSON P. LEWIS	Brooklyn, N. Y.
A. D. THOMPSON	Peoria, Ill.
ROBERT E. McMATH	St. Louis, Mo.
E. A. FISHER	Rochester, N. Y.
C. H. RUST	Toronto, Canada.
GEO. M. BALLARD (Deceased)	Newark, N. J.
A. PRESCOTT FOLWELL	New York City.
CHAS. C. BROWN	Indianapolis, Ind.
MORRIS R. SHERRERD	Newark, N. J.

STANDING COMMITTEES

Appointed by the President in accordance with Article IV, Section 4, of the Constitution of the Society.

1907-1908

Street Paving

ALLAN W. DOW, Chairman........................New York City.
E. L. DALTON..Dallas, Texas.
JOHN B. HITTELL....................................Chicago, Ill.

Electric Street Lighting

L. H. WEISSLEDER, Chairman....................Cincinnati, O.
W. J. STEWART......................................Rochester, N. Y.
EDWARD B. CODWISE..............................Kingston, N. Y.

Sewerage and Sanitation

EDWARD S. RANKIN, Chairman..................Newark, N. J.
NISBET WINGFIELD ....Augusta, Ga.
WILLIAM F. DAY....................................Detroit, Mich.

Water Works and Water Supply

J. L. LUDLOW, Chairman..........................Winston-Salem, N.C.
GEO. W. FULLER....................................New York City.
GEO. G. EARL...New Orleans, La.

Taxation and Assessment

W. H. V. REIMER, Chairman......................East Orange, N. J.
R. W. BALL..Henderson, Ky.
S. A. FRESHNEY......................................Grand Rapids, Mich.

City Government and Legislation

HORACE ANDREWS, Chairman....................Albany, N. Y.
R. E. MEADE..Birmingham, Ala.
JOSEPH STRACHAN ....Brooklyn, N. Y.

Disposition of Garbage and Street Cleaning

ROBERT K. DAVIS, Chairman.....................Detroit, Mich.
WM. J. PARKES.......................................Pine Bluff, Ark.
J. W. ALVORD...Chicago, Ill.

Municipal Franchises

C. C. BROWN, Chairman...........................Indianapolis, Ind.
H. E. BAKER...Watertown, N. Y.
A. R. GILCHRIST.....................................Montgomery, Ala.

Review

C. D. POLLOCK, Chairman.........................Brooklyn, N. Y.
J. N. HAZLEHURST...................................Atlanta, Ga.
WILLIAM PIERSON JUDSON.....................Broadalbin, N. Y.

SPECIAL COMMITTEES

Appointed by the President in accordance with resolutions adopted by the Society.

Municipal Data and Statistics

J. W. HOWARD, Chairman........................New York City.
H. W. WILMOT....................................New York City.
HUGO GROSSER ....Chicago, Ill.

Park Development and Maintenance

JAMES OWEN, Chairman.........................Montclair, N. J.
WILLIAM SOLOTAROFF ....East Orange, N. J.
FREDERICK MINSHALL ....Abbeville, S. C.

Fire Protection

ALCIDE CHAUSSE, Chairman....................Montreal, Can.
PETER PROVOST ....Ottawa, Can.
J. M. McCARTIN..................................Birmingham, Ala.

Exhibits for Next Meeting

E. F. LOWERY, Chairman........................Jackson, Mich.
G. M. INGRAM....................................Nashville, Tenn.
A. PRESCOTT FOLWELL........................New York City.
A. J. HILL..Chicago, Ill.
F. S. HUTCHINSON..............................New York City.
R. D. WOOD & CO...............................Philadelphia, Pa.

LIST OF MEMBERS.

Corporate Members

Ackerman, J. Walter, City Engineer, Auburn, N. Y.
Allen, C. R., Jr., Barre, Vt.
Allin, Thos. D., 72 N. Fair Oaks Ave., Pasadena, Cal.
Alvord, John W., Consulting Engineer, 127 Hartford Bldg., Chicago, Ill
Anderson, L. W., City Engineer, Grand Rapids, Mich.
Andrews, Horace, 125 Lancaster St., Albany, N. Y.
Arthur, William H., Superintendent of Public Works, Stamford, Conn.

Baker, Henry E., City Engineer, Watertown, N. Y.
Ball, R. W., City Engineer, Henderson, Ky.
Barlow, John R., City Engineer, Montreal, Canada.
Barr, J. Carroll, Economy, Pa.
Barrow, E. S., City Engineer, Hamilton, Ont.
Bauman, C. V., Board of Trade, Newark, N. J.
Benzenberg, Geo. H., Consulting Engineer, 1310 Wells Bldg., Milwaukee, Wis.
Berry, George, Assistant Engineer, Bureau of Highways, Borough of Brooklyn, N. Y.
Blair, Bryce R., City Engineer, Carbondale, Pa.
Bock, Frank J., Board of Public Works, Newark, N. J.
Boley, C. U., City Engineer, Sheboygan, Wis.
Bragg, Harry, Editor Canadian Municipal Journal, Montreal, Canada.
Breen, J. E., Chief Engineer, Board of Public Service, Cincinnati, O.
Briggs, B. E., City Engineer, Erie, Pa.
Brown, Charles C., Consulting Engineer, Editor Municipal Engineering, Indianapolis, Ind.
Brown, C. W., City Clerk, Winnipeg, Man.

Campbell, W. C., Superintendent Public Works, Columbus, Ga.
Carpenter, George A., City Engineer, Pawtucket, R. I.
Case, E. W., Colorado Springs, Colo.
Chairman of Municipal Council, St. Johns, Newfoundland.
Chausse, Alcide, Building Inspector, Montreal, Can.

Christy, L. V., Secretary Street and Sewer Dept., Wilmington, Del
Codd, George P., Detroit, Mich.
Codwise, Edward B., City Engineer, Kingston, N. Y.
Crandall, Wm. S., Tribune Bldg., New York City.
Dalton, E. L., City Engineer, Dallas, Texas.
Dalrymple, F. W., City Engineer, Bayonne, N. J.
Day, William F., Engineer in Charge of Sewers, Detroit, Mich.
Denman, A. R., President, Board of Street and Water Commissioners, Newark, N. J.
Dow, A. W., Consulting Chemist, 24-26 E. 21st St., New York City.

Earle, Geo. G., Gen'l Supt. Sewerage and Water Board, New Orleans, La.
Eggers, Augustus F., Board of Works, Newark, N. J.
Elwood, F. T., Rochester, N. Y.
Ely, John H., Architect, Newark, N. J.

Fisher, E. A., City Engineer, Rochester, N. Y.
Floyd, William H., Jr., City Engineer, St. Joseph, Mo.
Folwell, A. Prescott, Editor, Municipal Journal and Engineer, Flatiron Bldg., New York City.
Fort, E. J., Assistant Engineer, Bureau of Sewers, Borough of Brooklyn, N. Y.
Fortune, Wm., Publisher Municipal Engineering, Indianapolis, Ind.
Freiberg, M. J., Waterworks Commission, 216 E. Front St., Cincinnati, O.
Freshney, S. A., Secretary and General Manager, Board of Public Works, Grand Rapids, Mich.
Fuller, George W., Consulting Engineer, 170 Broadway, New York City.
Fuller, W. B., Engineer in charge of Filtration, Dept. of Water Supply, Manhattan, New York.

Gainey, W. H., City Engineer, Valdosta, Ga.
Giddings, Fred, City Engineer, Atchison, Kan.
Gilchrist, Allen R., City Engineer, Montgomery, Ala.
Goodell John M., Editor Engineering Record, 114 Liberty St., New York.
Goodsell, Daniel B., Ass't Engineer, Bureau of Highways, Manhattan, New York.
Greathead, Wm. E., Newark, N. J.
Griffith, John E., Assistant Engineer, Dep't of Water Supply, Borough of Brooklyn, N. Y.
Griggs, Julian, Scioto Valley Traction Co., Columbus, O.
Grosser, Hugo S., City Statistician, 207 City Hall, Chicago, Ill.

Halpin, Thos. F., Board of Public Works, Newark, N. J.
Hamell, J. M., City Engineer, Hull, Que.
Harper, E. A., City Engineer, Kansas City, Mo.
Hatton, T. Chalkly, Consulting Engineer, Wilmington, Del.
Haussling, Jacob, Mayor, Newark, N. J.
Hazlehurst, J. N., Consulting Engineer, Atlanta, Ga.
Henry, P. W., Consulting Engineer, 90 West St., New York City.
Herrman, August, President Waterworks Commissioners, Cincinnati, O.
Hinds, Frank A., Consulting Engineer, Watertown, N. Y.
Hittell, John B., Chief Engineer of Streets, Chicago, Ill.
Howard, J. W., Consulting Engineer, No. 1 Broadway, New York, N. Y.
Howe, W. B., City Engineer, Concord, N. H.
Howell, Wm. A., Engineer, Street Dept., Newark, N. J.

Johnson, Edward J., City Engineer, Nashua, N. H.
Johnston, A. L., Sewer Department, Wilmington, Del.
Jones, John, Superintendent of Streets, Toronto, Ont
Judson, William Pierson, Broadalbin, Fulton Co., N. Y.

Kay, Prof. Edgar B., University of Alabama, Tuscaloosa, Ala.
Kendrick, Julian, City Engineer, Birmingham, Ala.
Ker, N. I., City Engineer, Ottawa, Can.
Kummer, F. J., New York City.

Lambert, Geo. H., Commissioner, Board of Public Works, Newark, N. J.
Leonard, C. E., City Engineer, Austin, Texas.
Lewis, N. P., Chief Engineer Board of Estimate and Apportionment, New York City.
Ludlow, J. L., Consulting Engineer, Winston-Salem, N. C.
Luster, W. H., City Surveyor, Elizabeth, N. J.

McCartin, J. M., Superintendent of Streets, Birmingham, Ala.
McClintock, John N., Consulting Engineer, 45 Milk St., Boston, Mass.
McCormick, R. H., City Engineer, Detroit, Mich.
McMath, Robert E., 327-328 Lincoln Trust Bldg., St. Louis, Mo.
McMillan, Chas., City Clerk, Calgary, Canada.
Markbreit, L., Waterworks Commission, Cincinnati, O.
Marston, Frank L., Consulting Engineer, Stockton Springs, Me.
Mead, D. W., 605 First National Bank Bldg., Chicago, Ill
Meade, R. E., Consulting Engineer, 1520 Brown-Marx Building, Birmingham, Ala.
Melvin, T. H., Sewer Dept., Wilmington, Del.
Minshall, Frederick, Consulting Engineer, Abbeville, S. C.

Mitchell, J. K., Asst. City Engineer in Charge of Sewers, Detroit, Mich.
Monie, John M., City Engineer, Bonne Terre, Mo.
Murphy, F. E., Supt. of Streets and Waterworks, Huntsville, Ala.

Nelson, John A., City Engineer, Mitchell, S. D.

O'Brien, F. J., 112 W. Bridge St., Oswego, N. Y.
Owen, Jas., Consulting Engineer, 196 Market St., Newark, N. J.

Parent, Arthur, Supt. City Lighting Dept., Montreal, Canada.
Parker, G. A., Superintendent Keney Park, Hartford, Conn.
Parkes, William J., City Engineer, Pine Bluff, Ark.
Phinney, F. J., Superintendent Water Works, Rockford, Ill.
Pollock, Clarence D., Assistant Engineer, Bureau of Highways, Manhattan, N. Y.
Potter, W. G., City Engineer, Greensboro, N. C.
Provost, A. J., Jr., 39-41 W. 38th St., New York.
Provost, Peter, Chief Fire Dept., Ottawa, Canada.
Putnam, J. E., Assistant City Engineer, Rochester, N. Y.

Rankin, E. S., Engineer of Sewers and Drainage, Newark, N. J.
Reed, Alex., U. S. Wood Preserving Co., 29 Broadway, New York, N. Y.
Reichardt, Walter F., Assistant City Engineer, Little Rock, Ark.
Reimer, W. H. V., City Engineer, East Orange, N. J.
Riter, George W., Salt Lake City, Utah.
Rommel, Geo., Jr., Engineer Street and Sewer Dept., Wilmington, Del.
Rust, Chas. H., City Engineer, Toronto, Ont.
Ruttan, H. N., City Engineer, Winnipeg, Manitoba.

Sanderson, H., Alderman, Winnipeg, Man.
Schmidt, Jacob, Assistant Engineer, Bureau of Highways, Borough of Brooklyn, N. Y.
Sheridan, John C., Assistant Engineer, Bureau of Highways, Borough of Brookyln, N. Y.
Sherrerd, M. R., Chief Engineer, Dept. of Public Works, Newark, N. J.
Shipman, Charles M., Gen'l Supt. of Works, Newark, N. J.
Smith, James J., City Engineer, Grand Forks, N. D.
Solotaroff, William, Supt. Shade Tree Commission, East Orange, N. J.
Stewart, Wm. J., First Assistant City Engineer, Rochester, N. Y.
Stobaeus, J. B., 160 Clifford St., Newark, N. J.
Strachan, Joseph, Assistant Engineer, Bureau of Highways, Borough of Brookyln, N. Y.

Talbot, A. N., Professor of Civil Engineering, University of Illinois, Urbana, Ill.

Taubenheim, Ulrich E., Manager City Waterworks, Archangel, Russia.

Thompson, A. D., 304 Masonic Temple, Peoria, Ill.

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